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ARCHITECTS AND BUILDERS

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VOL. XVII. 1914

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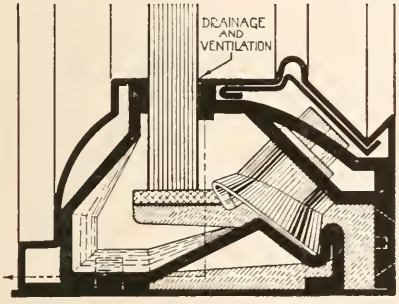

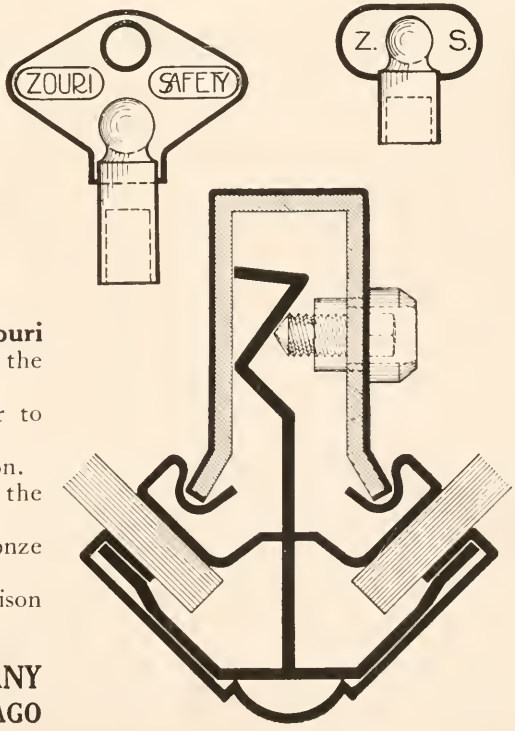

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For

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1914

SEVENTEENTH YEAR

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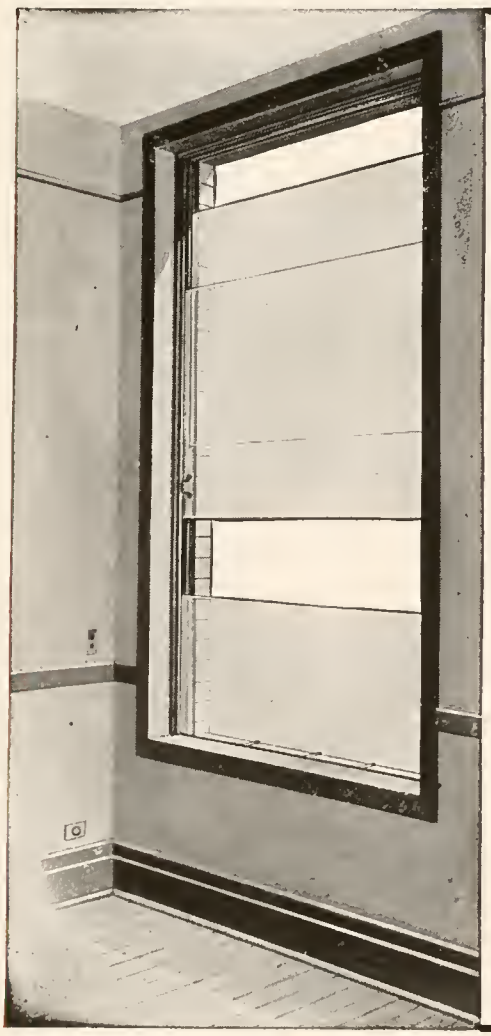

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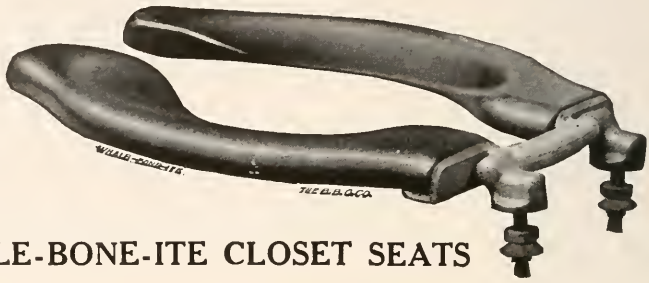

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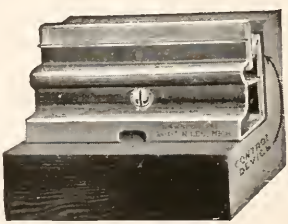

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PREFACE

In presenting the Seventeenth Edition of Handbook for Architects and Builders we have to call attention to the change in name of the organization under whose auspices this book has been issued.

On June 23, 1914, the Chicago Architects' Business Association changed its name to the **Illinois Society of Architects.** This edition of the Handbook is therefore published under the auspices of the Illinois Society of Architects; otherwise there is no change in the scope and purpose of the work. Emery Stanford Hall still continues his duties as editor.

The same general plan of arrangement that has proved satisfactory in former editions is continued in this edition.

Subject matter republished from previous editions has been carefully revised, corrected and extended.

The Building Ordinances have been carefully compared, direct from the original minutes of the City Council, and are presented as usual, with all amendments printed in italics. These amendments include all actions of the City Council relative to building up to and including the meeting of July 30, 1914, which was the last meeting before their adjournment for summer vacation.

Mr. F. J. Postel continues his work as editor of matter pertaining to electrical and mechanical engineering.

Mr. H. A. Gardner, Assistant Director Institute of Industrial Research, Washington, D. C., presents an interesting discussion of painters' materials for various purposes.

The Dewey Index for classifying and filing drawings has been completely revised and extended.

We publish through the courtesy of the American Society for Testing Materials some of the latest reports of this Society.

The Handbook covers a peculiarly exclusive field in this state, which makes it a recognized reference work for every one interested in architecture and building in this locality.

Our Classified List furnishes the architect with a list of those engaged in the manufacture and sale of building material and the contracting business. We have exercised our best judgment in the selection of those represented in our book and we urge architects desiring the names of contractors and material firms to use this list.

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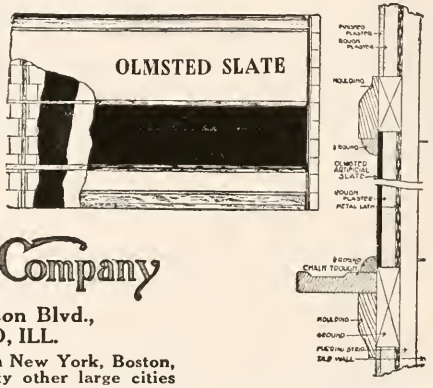

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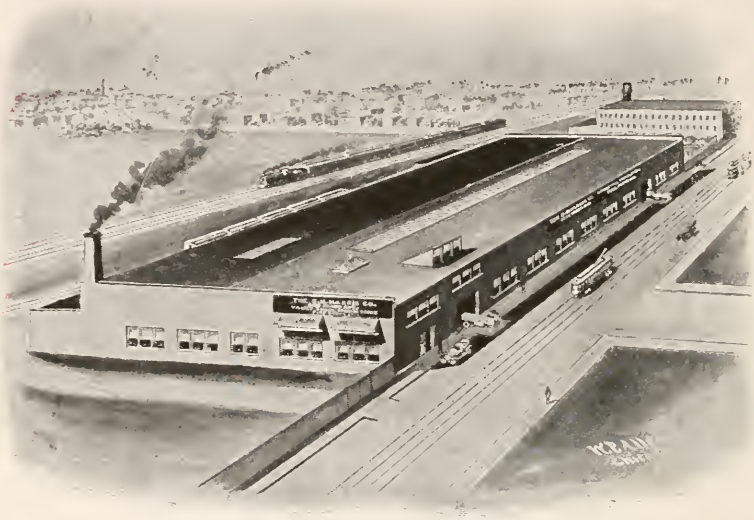

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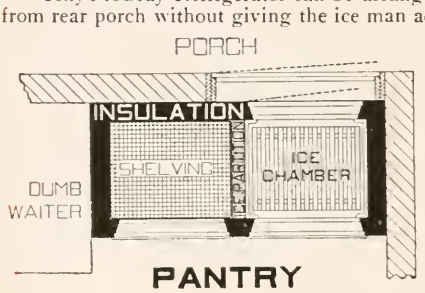

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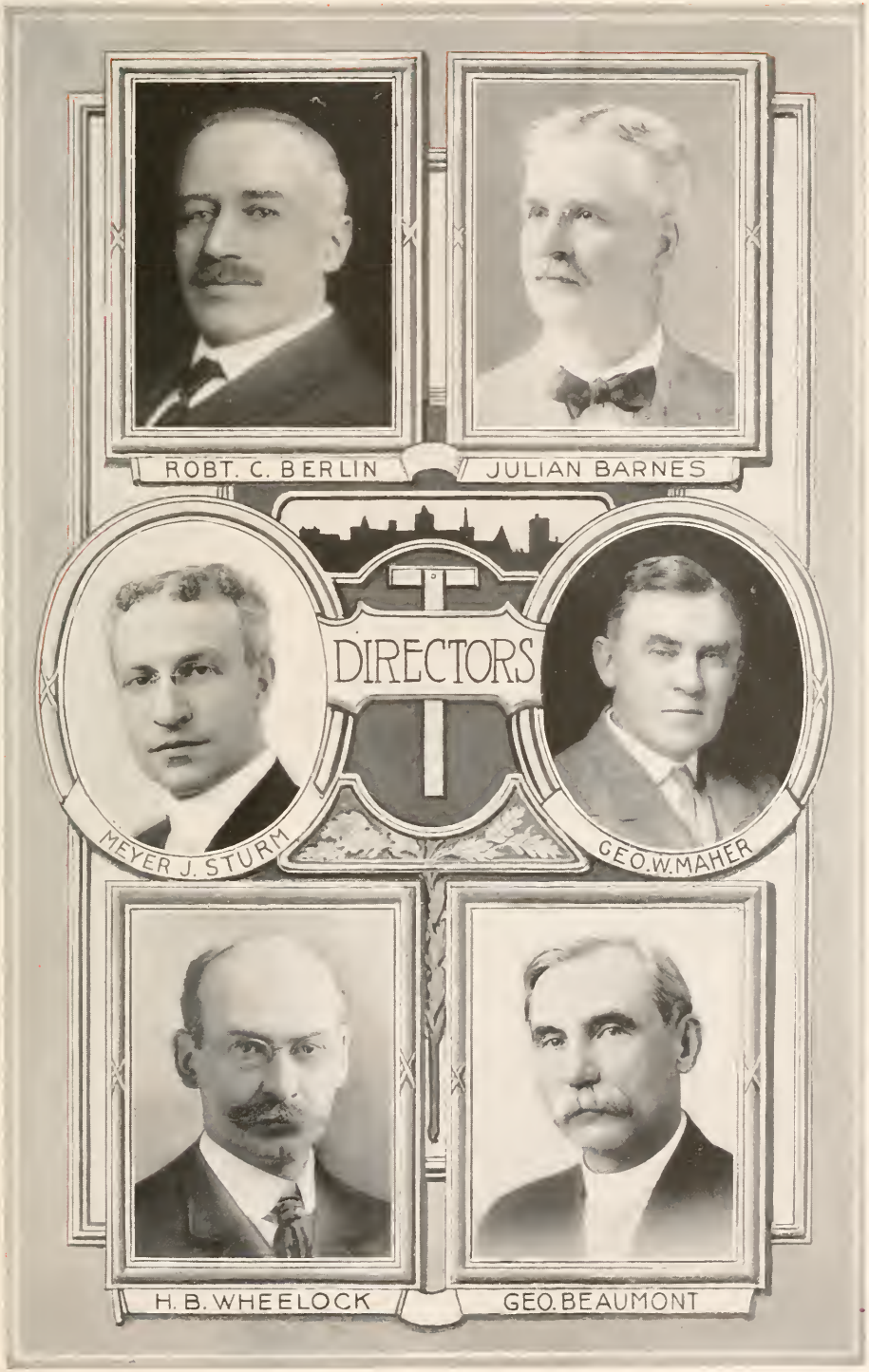
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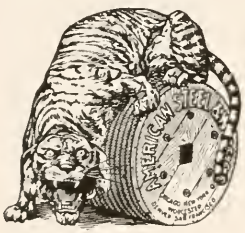

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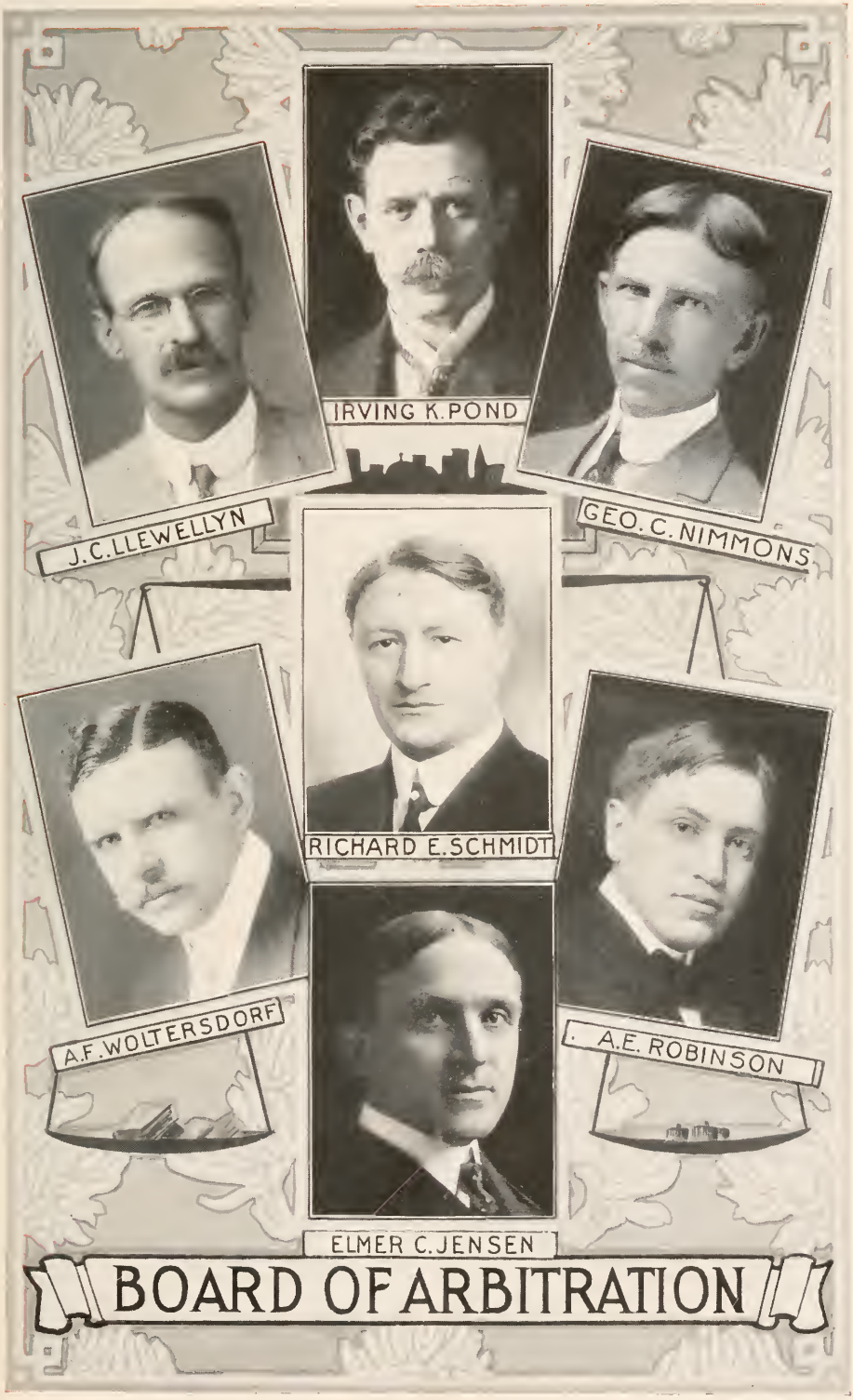
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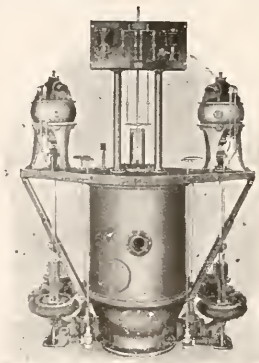

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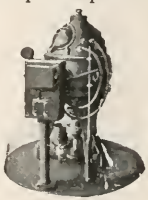

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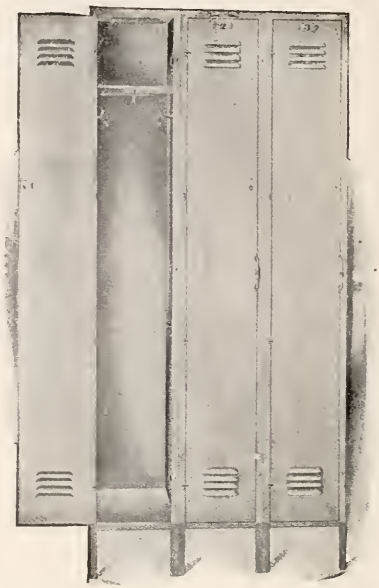

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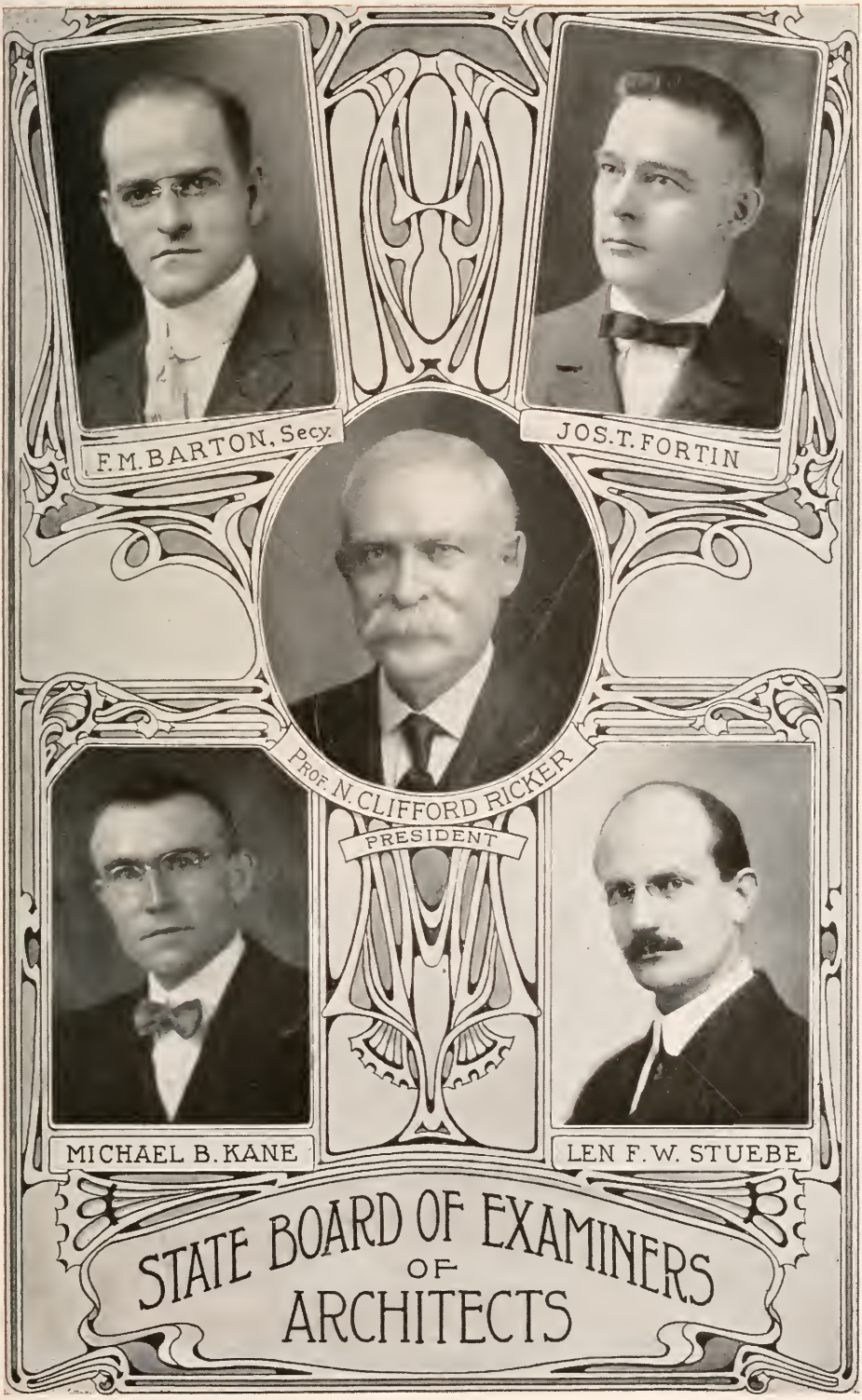
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EDITORIAL

Progress has marked the activities of our organization during the past year. Much time and expense amounting to thousands of dollars has been given to the work on collecting evidence and presenting same before the proper legal authorities relative to violation of laws pertaining to the practice of architecture and building. Mandamus proceedings have been instituted to determine the possibility of requiring the Building Department of the City of Chicago to uniformly enforce the building laws. Such proceedings have been successful in the lower court and are now pending in the Appellate Court. A number of cases of violation of Illinois license law has been presented before the State Board. As a result of our activities in the collection and presenting of evidence at trials of architects it has become apparent to us that there are certain weaknesses in the laws regulating this practice, which need correction.

This is particularly true with reference to rules regulating proceedings before the Board. This organization, on recommendation of its Committee on Public Action, has adopted resolutions in favor of having trials of architects presided over by a judge of a court of record. It seems incongruous to only require a majority vote of the membership of the Board to secure the granting of a license to practice architecture and to require a unanimous vote of the Board to secure the discipline of an offender against the law. If only a majority vote of the members of the Appellate or Supreme Court of the state is required for decision, surely the same rules ought to apply in the matter of the decisions of the Board regulating the practice of architecture. Even the Supreme Court of the United States, often conceded to be the greatest tribunal in the world, requires only a majority vote to render a decision. Laws ought also to be promulgated so as to make it impossible for a single political administration to change the entire complexion of the Board while action is pending before it, involving the standing of one prominent in the support of such administration.

It is difficult to adequately express appreciation of the splendid work of the officers and committees of the last administration of the Association, in their efforts for the benefit of the profession; the committee on Public Action meriting especial commendation for its work executed under unusually trying circumstances. In fact, the work of the Committee on Public Action has increased to such a large extent that it was felt prudent at the annual business meeting to divide this work, and now three committees will do the work formerly assigned to this committee.

We cannot help but view with disfavor the growing tendency on the part of certain general contractors to try to secure for themselves the functions of the architect as well as the contractor. The public should be fully informed as to the evil consequences to them of such combination.

For a long time a sentiment has been growing in favor of a change in the name of the Association; it was felt that the name of the Association did not properly express the scope of its work. Various tentative names were submitted to the members for consideration, by preferential letter-ballot. This ballot revealed a strong preference in favor of changing the name from the Chicago Architects' Business Association to the Illinois Society of Architects. Proper notice being given, proposed change in name was made an accomplished fact, at the annual business meeting held on June 23, 1914. We now come before you as the official organ of the Illinois Society of Architects, successor to Chicago Architects' Business Association.

Experience of the various committees engaged in attempt to secure the enforcement of laws and obtain needed legislation, has made it apparent that there should be a closer union between all of the architects licensed to practice in this state. With this end in view, resolutions were passed by our organization authorizing the creation of a Convention Committee, whose duties are to make the necessary arrangements for the holding of a state convention, to which all architects licensed to practice in this state would be accredited as delegates. At the time of going to press the Convention Committee is rushing a vigorous campaign toward making this proposed convention a decided success. This committee has completed arangements for holding proposed convention at the La Salle Hotel, Chicago, October 7th and 8th, 1914. It is hoped that when this convention convenes that the fullest possible discussion will be had of those problems which confront the architects of this state. It would also seem desirable that some means be taken as an outgrowth of this meeting to bring together all of the architects of this state in a strong, cohesive organization, which shall be able to adequately represent the interests of our profession in this locality.

One of the greatest obstacles in the way of architectural practice is a lack of knowledge on the part of the general public as to what constitutes proper practice. To correct this evil a campaign of education is necessary. The duty of instituting such a campaign properly falls on our profession. It is hoped that the coming convention may devise means to secure a better general understanding of the importance and proprieties of our profession.

The movement in the interests of securing the adoption of standard sizes of catalogs and literature for distribution to architects has received great impetus in the adoption

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of standard sizes by the American Institute of Architects. This organization has seen fit to change the sizes originally adopted as its standard, to comply with those adopted by the American Institute of Architects (see detailed report of the action of the Society on this subject in another part of this book). Architects are urged to use their influence to persuade publishers of catalogs to comply with standard sizes.

The increased scope of activities of the Society has made it necessary to revise the By-laws so as to increase its working organization. The work formerly required of the Secretary by revision of the By-laws is now divided between two officers; the Secretary and the Financial Secretary. The major portion of routine details including the sale of forms, keeping of accounts with members, the purchase of printing matter, arrangement for meeting places and entertainment, has been placed in the hands of the Financial Secretary, whose work is under the general supervision of the Secretary.

We cannot but view with disfavor the growing tendency toward a too minute subdivision of building labor. While admitting that building to a certain extent is complicated, an analytical study cannot fail to reveal that the general divisions of mechanical art involved are not anywhere near as numerous and complicated as would appear by an examination of a list of the various labor unions claiming jurisdiction over portions of building construction. Building labor is suffering from over organization and from unscientific classification. In making this assertion, we do not wish to be understood as in any sense opposed to the organization of labor. We believe such organization to be essential under modern conditions. The difficulty is not with organization but multiplicity of organization containing meaningless subdivisions. Every mechanic to be efficient must be reasonably skilled in the natural division of work of which his specialty is a part. Specialization based on a thorough knowledge of the general type of work involved is beneficial, but divisions of any given type of work overlap each other and are intimately interlaced. It is therefore impossible to secure the highest degree of efficiency of execution on any division of a type of work unless the workman possesses sufficient skill to be able to execute with fair degree of speed and reasonable accuracy, any work involved by the type. For illustration, a medical specialist must have attained reasonable knowledge of the human body and Materia Medica before taking up a specialty. Such knowledge must be sufficient to prepare him for emergency work in any part of the human system.

Under ordinary conditions, in the larger operations, specialized service is more economical. In such cases a higher degree of speed and skill of execution can be attained where workmanship is minutely subdivided. It does not follow, however, that because a given workman is engaged on a particular kind of work that he should not be able to do reasonably well, at a lessor degree of speed, any work falling under that division. In the case of the smaller operations, specialized service in many cases is impractical and works a great hardship on owner and contractor by making the cost of this class of buildings excessive in proportion to size. By increasing the cost of small buildings, these are made unprofitable investments at the same space rental as larger buildings; thus requiring either an abandonment of this class of investment or a raise in rental —all of which constitutes an attack on the home of the artisan, and fosters the great tenement house, that festering sore of congested society.

While specialized service is effective and economical during the progress of large operations, it is very wasteful at the beginning and end of such operations, at such periods it often occurs that there is only a few minutes work to be done in each of a dozen specialties falling under a given general division—all of which could be readily executed by any competent mechanic working in that division. It cannot be argued as profitable to mechanics to be called to do a single hour's work in an isolated position, as the loss of time is much more serious to the mechanic than to the employer, and it would be far better to allow one man to do all of the work which he is capable of doing under his general division. Unfortunately the same method of handling business propositions cannot be followed in the building industry, due to illogical divisions of labor brought about by selfish labor organizers, largely for the purpose of conserving personal interests. By far the greatest losses on account of labor disturbances, to the building industry in the last few years, have been due to jurisdictional disputes, wholly apart from the question of wages or working conditions; resulting in great loss to mechanics and without compensating gain of any sort. Such conditions also have a tendency to encourage petty grafting on the part of minor labor politicians, tending to bring disrepute on organized labor as a whole.

We contend that the evils of labor organization could be largely if not entirely eliminated so far as building operations are concerned if the number of unions was materially decreased, and the number of men in the various unions more nearly balanced. For illustration, suppose that all mortar using trades were brought together in one union and all pipe using trades brought together in another union. And all sheet, structural and ornamental metal trades brought together in one union. And all preservative and decorative trades brought together in a single union. Each union would be large enough to eliminate factional control and petty personal interests, and would contain within it practically all of the overlapping specialties which have produced jurisdictional disputes. It must be conceded that notwithstanding the numerous present subdivisions of the divisions as suggested that the fundamental underlying principles essential to skill in any single subdivision are common to all. One able to do any part of this work with high degree of skill must have a reasonable working knowledge of all.

Death has removed from our midst three men who have long been prominent in Chicago: S. S. Beman, chiefly noted for his early work as designer of the town of Pullman and his later work on many Christian Science churches; John Sutcliffe, especially remembered for his work in Gothic in the design of numerous Episcopal churches; J. J. Flanders, chiefly remembered by his work on industrial buildings. The profession has suffered a great loss by the removal of these strong men from our midst.

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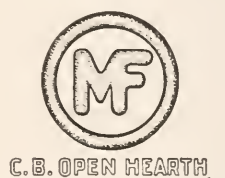

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THE ILLINOIS SOCIETY OF ARCHITECTS
CANONS OF PROFESSIONAL ETHICS

Preamble.

The architect is engaged in a profession which carries with it grave responsibilities to the public. These duties and responsibilities cannot be met unless the motives, conduct and ability of the members of the profession are such as to command respect and confidence.

The profession of architecture calls for men of the highest integrity, and executive and artistic ability.

The architect is entrusted with financial undertakings where his honesty of purpose must be above suspicion; he acts as professional adviser to his client, and his advice must be absolutely disinterested: he is charged with the exercise of judicial functions as between client and contractor, and must act with entire impartiality, and he has moral responsibilities toward his professional associates and subordnates.

The people of the State of Illinois have a right to expect a high standard of practice and conduct on the part of the architects whom they have licensed to practice. Because an architect is a quasi public official it is imperative that he assume no obligations which shall place official duty and self-interest in conflict.

The Canons of Ethics.

No set of rules can be framed which particularize all the duties of the architect in his various relations to the public, to his client, to the building trades and to his professional brethren.

The following canons of ethics cover certain broad principles which should govern the conduct of members of the profession and should serve as a guide in circumstances other than those enumerated:

I.—On Certain Duties to the Public.

The architect's more important work is of a character so permanent and enduring that he owes it to the public to use his best efforts to make it such as may raise the standard of taste in the community and be in itself a public ornament. He should design with due regard to surroundings and should endeavor to check any individualism, whether in himself or his client, that is opposed to the public good. He should take part in those movements for public betterment in which his training and experience enable him to give useful service. He should insist on safe and sanitary construction and he should at all times hold the safe guarding of human life and health as of paramount importance to the interests of client, contractor or self.

II.—On the Architect's Status.

The architect's relation to his client is primarily that of professional advisor. This relation maintains throughout the entire period of his service. When, however, a contract is executed between his client and a builder or other person by the terms of which the architect becomes the official interpreter of its conditions and the judge of its performance, a new relation is created. In respect to the matters under contract, it is incumbent upon the architect to side neither with the client nor contractor, but to endeavor, in so far as his action may determine, that the contract be faithfully carried out according to its true spirit and intent.

It is not proper for the architect to assume to act as the owner's agent unless he has been specifically empowered so to act: by so doing he becomes a party to the contract and in a sense disqualified in his judicial capacity.

The fact that the architect's payment comes through the client does not invalidate his professional obligation to act with impartiality to both parties to the contract. It is essential, however, in order to eliminate the influence of self-interest, that the architect shall not enter into any contract with the client which shall condition his payment upon his decisions or advice.

III.—On Preliminary Drawings and Estimates.

The architect should impress upon his client at the outset the importance of sufficient time for the study and preparation of drawings and specifications. If, on the basis of approved preliminary

170 Quarts Of Nitroglycerine Did not Crack "NATIONAL" Pipe

¶ The following letter from the user of the piece of "NATIONAL" Pipe illustrated above speaks for itself.

¶ "We recently shipped you a joint of 5 3/16-in. casing* for inspection. This joint was part of a liner which was placed in a well near Gore, Ohio, after same had been completed and shot. We decided to give the well a second shot, and placed in same 150 quarts of nitroglycerine with a 20-quart anchor shot. We then pulled the liner and, after getting it out, we discovered that one joint was still in the hole. We decided to put the shot off with the hope that the joint of liner would come out following the shot. It, however, lodged about 1,500 feet from the top and after working with it for some few days we were able to put a bell socket over same and brought out the joint in the condition that you have found it. Would say that this well was 3,000 feet deep and the 6 5/8-inch casing was not damaged in any way."

¶ Although the original length of the pipe was probably 18 feet, it was reduced by the nitroglycerine "shot" to about 8 feet. In not one case in a million would the same combination of circumstances arise, even if a person started out to repeat the operation and was so far successful there would be small chance of bringing the crushed pipe to the surface, for it would stick somewhere on the way.

¶ Probably in this actual example there is the best possible demonstration of the toughness of material used in "NATIONAL" Pipe, for the great punishment to which the casing was subjected twisted and distorted it, yet, notwithstanding this, the casing shows practically no fractures. In the one or two places a slight abrasion occurs, these show by their position they were caused when the material was being drawn out of the hole, and not when "shot."

¶ The holes at the right end were drilled by the chemist for the chemical analysis which showed the material was Bessemer steel.

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sketches, the approximate cost of the work has been mutually considered, the architect should endeavor to bring his working drawings to meet such approximate cost, provided that his client has requested no departure from the original basis of estimate. But at the same time he should acquaint his client with the conditional character of preliminary estimates. Complete and final figures can be had only from complete and final drawings and specifications. If an unconditional limit of cost is imposed before such drawings are made and estimated, the architect must be free to make such adjustments as seem necessary to that end.

IV.—On Superintendence and Expert Service.

On all work except the simplest, it is to the interest of the client to employ an inspector or clerk-of-the-works; in many engineering problems and in certain esthetic problems such as sculpture, decorative painting, gardening and the like, it is to the interest of the client to have specialized expert service. The architect should so inform the client and assist him in obtaining such service. In order to secure unified and harmonious working organization, only such persons should be selected by the owner for consulting experts as shall work in harmony with the architect and shall be approved by him.

V.—On the Architect's Charges.

The schedule of charges of the Chicago Architect's Business Association is recognized as a proper minimum of payment, but where no other architect is affected it is allowable for an architect to make such an arrangement with his client as is mutually satisfactory. He may not reduce his fee below the schedule of charges in an attempt to supplant another architect; it is reasonable and proper to charge higher rates than those of the schedule when his special skill and the quality of his service justify the increase.

A system of compensation based on the actual cost to the architect on a given piece of work plus an agreed professional fee, has much to commend it.

VI.—On Needless Expenditure.

The architect should scrupulously guard cost, and refrain from introducing needless expense or any extravagance in material or construction that may add to cost of building, without compensating gain to the client.

VII.—On Payments for Expert Service.

When retained as an expert, whether in connection with competitions or otherwise, the architect should receive a compensation proportionate to the responsibility and difficulty of the service. No duty of the architect is more exacting than such service, and the honor of the profession is involved in it. Under no circumstances should experts, knowingly, name prices in competition with each other for a given employment. Where governmental regulations prohibit adequate compensation for expert service, it is better to render such service without emolument than to accept a payment out of proportion to the importance of the service rendered.

VIII.—On the Selection of Bidders or Contractors.

The architect should advise his client in the selection of bidders and in the award of contract.

In selecting none but worthy bidders and in advising the award only to contractors who are honest and competent, the architect protects the interests of his client and helps to raise the ethical standard in building.

IX.—On Duties to the Contractor.

On the signing of a contract between owner and builder, the architect is placed in a judicial position and is bound to act with absolute fairness; he is also judge in his own right, deciding whether or not the intent of his plans or specifications is properly carried out, and exercising his judgment as to the true meaning thereof. He should, therefore, take special care to see that these drawings and specifications are complete and accurate, and he should never call upon the contractor to make good his own oversights or errors, or attempt to shirk responsibility by "blanket" clauses.

X.—On Engaging in the Building Trades.

The architect should not engage in any of the building trades, nor should he form any trade partnership or agreement with any person or firm connected therewith;

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nor should he have any financial interests in any building material or device of such a nature as to render his professional action liable to a suspicion of self-interest: if he have any interest in building material or device, he should not specify or use the same without the full knowledge and approval of his client.

XI.—On Accepting Commission or Favors.

The architect may not receive any commission or any substantial service or favor from a dealer, a contractor, or from any interested person other than his client.

XII.—On Encouraging Good Workmanship.

In his authority to interpret and enforce the provisions of the contract, the architect is vested with large powers which he should use with unbiased judgment. While he must condemn bad work, he should also make a point of commending that which is good.

Intelligent initiative, artistic or mechanical, on the part of craftsmen and workmen, should be promptly recognized and encouraged, and the architect should make evident his appreciation of the dignity and importance of their work.

XIII.—On Offering Service Gratuitously.

The offering of professional service on approval, unless warranted by personal or previous business relations, tends to lower the dignity and standing of the profession: also to provide motive for dishonest representation and is to be condemned.

XIV.—On Advertising.

Advertising in any form is to be discouraged as tending to lower the standing of the profession. The presentation of ordinary business cards is a matter of individual taste and not per se improper; but the solicitation of work by circulars or advertisements and the inspiring or inserting of self-laudatory notice in the press are unprofessional.

The best recommendation of an architect is a well-merited reputation for professional capacity and fidelity to trust.

XV.—On Signing Buildings and Use of Titles.

The signing of buildings has the indorsement of the Chicago Architect's Business Association. The use of the initials designating degrees or technical society membership is proper in connection with any professional service and is encouraged as helping to make known the nature of the honor they imply.

XVI.—On Competitions.

In no way does the architect come more conspicuously before the public than through competitions. It is especially desirable that in such circumstances he should conduct himself with self-respect and dignity. To under value and cheapen his service or to compete where a just award is not safe guarded is inconsistent with this position. Competitions are undesirable from the standpoint of both the client and the architect and a member of of the Association should discourage the holding of same. If a competition becomes inevitible, because of governmental regulations, he should not enter either as a competitor or a professional advisor unless the competition is to be conducted according to the best practice and usage of the profession as formulated from time to time by the American Institute of Architects. Except as an authorized competitor he may not attempt to secure work for which competition has been instituted.

He may not present drawings to secure work for which competition has been closed but not decided.

He may not attempt to influence the award in any competition.

XVII.—On the Expert's Future Status.

An architect may not undertake a further commission on any building or work after having acted in an expert capacity in formulating a program which later is put into effect, or after having acted in an advisory capacity in the matter of awards in competition. Having acted in either or both of such capacities should bar an architect from eligibility to execute commissions upon the work in question.

XVIII.—On Criticising the Work of Others.

An architect may not criticise publicly in the press the work of a fellow architect except over his own signature, or editorially; and he may not intentionally injure, directly or indirectly, the reputation, prospects or business of a fellow architect.

XIX.—On Undertaking the Work of An other.

An architect may not undertake a commission while the just claim of a fellow architect, who had previously undertaken it, remains unsatisfied; nor may he attempt to supplant a fellow architect or to obtain a commission after steps have been taken toward the appointment of another architect.

XX.—On Duties Toward the Student Draughtsman.

It is the duty of the architect to advise and assist those who intend making architecture their career. The intending student should be urged to secure a preparation of broad general culture equivalent to that required for the degree of A. B., concurrently with or followed by a thorough course in a well organized school of architecture.

In cases where such preparation is out of the question and the beginner must get his training in the office of an architect, the latter should assist him to the best of

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his ability by instruction and advice. An architect, should, as far as possible, urge his draughtsmen to avail themselves of educational opportunities. To this end he should give encouragement to all worthy schemes and institutions for architectural education.

Members of the association cannot too strongly insist that a thorough technical preparation for the practice of architecture should rest upon a foundation of general culture.

XXI.—On Duties Toward Building Authorities.

The architect should support all federal, state and municipal officials who have charge of matters relating to building and endeavor to maintain or improve the standards of their departments. His quasi public official capacity requires him to show respect for law by careful and conscientious compliance with all building regulations, and if any such appear to him unwise or unfair, he should endeavor to have such regulations altered, but until so altered he should comply with them. An architect because of his official relation to the state and of his moral obligation should not even under his client's instructions encourage any practices contrary to law or hostile to public interests; for he is not obliged to accept a given piece of work, hence he cannot urge in extenuation and to escape the condemnation attaching to his acts that he has but followed his client's instructions.

XXII.—On Professional Qualifications.

The assumption of the title of architect should be held to mean that the bearer has the professional knowledge, both theoretical and practical, and the natural ability needed for the proper invention, illustration and supervision of all building operations which he may undertake.

XXIII.—On Matters Adjudged Unprofessional.

The following code, based on a report of a special committee of the American Institute of Architects, is adopted by the Chicago Architects' Business Association as a general guide, yet the enumeration of particular duties should not be construed as the denial of the existence of others equally imperative though not specifically mentioned. It should also be noted that these sections indicate offenses of greatly varying degrees of gravity:

It is unprofessional for an architect—

1. To engage in any of the building trades or to form any trade partnership or agreement with any person or firm engaged therein.
2. To guarantee an estimate or contract by bond or otherwise.
3. To accept a commission or any substantial service or favor from a contractor, or anyone connected with the building trades.
4. To advertise in any form.
5. To enter any competition the terms of which are not in harmony with principles approved by the American Institute, especially if such terms have been specifically condemned by the American Institute or a local chapter thereof.
6. To attempt in any way except as a duly authorized competitor to secure work for which a competition has been instituted.
7. To attempt to influence the award of a competition.
8. To injure intentionally the fair reputation, prospects or business of another architect.
9. To criticise anonymously in the public prints, except editorially, the professional conduct or work of a fellow architect.
10. To undertake a commission while the just claim of another architect who has previously undertaken it remains unsatisfied.
11. To attempt to supplant a fellow architect after definite steps have been taken toward his employment.
12. To offer or perform services at rates lower than those approved as minimum by the Chicago Architects' Business Association in an attempt to supplant or underbid another architect.
13. To act in a manner detrimental to the best interests of the profession.

SCHEDULE OF PROPER MINIMUM CHARGES AND PROFESSIONAL PRACTICE OF ARCHITECTS RECOMMENDED BY THE ILLINOIS SOCIETY OF ARCHITECTS

1. The architect's professional services consist of the necessary conferences, the preparation of preliminary studies, working drawings, specifications, large scale and full size detail drawings, and of the general direction and supervision of the work, for which, except as hereinafter mentioned, the minimum charge is six per cent (6%), based upon the total cost of the work complete.

In case of the discontinuance or abandonment of the work, the architect's charge shall be based upon an *estimated* total cost, which estimated total cost may be determined by the architect, by experts, or by the lowest bids of responsible contractors. *Total cost* is to be interpreted as the cost of all materials and labor necessary to complete the work, plus contractors' profits and expenses, as such cost would be if all materials were new and all labor fully paid, at market prices current when the work was ordered.

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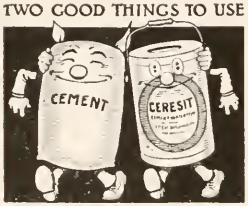

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2. On residential work, on alterations to existing buildings, on monuments, furniture, decorative and cabinet work, and landscape architecture, it is proper to make a higher charge than above indicated.

3. The architect is entitled to compensation for articles purchased under his direction, even though not designed by him.

4. If an operation is conducted under separate contracts, rather than under a general contract, it is proper to charge a special fee in addition to the charges mentioned elsewhere in this schedule.

5. Where the architect is not otherwise retained, consultation fees for professional advice are to be paid in proportion to the importance of the questions involved and services rendered.

6. Where heating, ventilating, mechanical, structural, electrical and sanitary problems are of such a nature as to require the services of a specialist, the owner is to pay for such services in addition to the architect's regular commission. Chemical and mechanical tests and surveys, when required, are to be paid for by the owner.

7. Necessary traveling expenses are to be paid by the owner.

8. If, after a definite scheme has been approved, changes in drawings, specifications or other documents are required by the owner; or if the architect be put to extra labor or expense by the delinquency or insolvency of a contractor, the architect shall be paid for such additional services and expense.

9. The architect's entire fee is itemized and proportionate payments on account are due the architect, as the following items are completed:

Preliminary Studies	.2
General drawings	.3
Specifications	.1
Scale and full size details	.1
General Supervision of the work	.3
Total	1.00

Fee for complete services as agreed, or see paragraphs 1 and 12.

10. Items of service are comprehended as follows:

(a) **Preliminary Studies** consist of the necessary conferences, inspections, studies and sketches modified and remodified to determine the client's problem and illustrate a satisfactory general solution of same, both as to plan and elevation. Illustrative sketches for this purpose need not be to accurate scale, but should be approximately correct as to general dimensions and proportion.

(b) **General Drawings** include figured scale plans of the various stories, elevations of all the fronts, such general vertical sections as may be necessary to elucidate the design, and such details, drawn to still larger scale as, with the assistance of printed notes, and of the accompanying specifications, may make the whole scheme clearly evident to the mind of the competent builder and give him a full and complete comprehension of all the structure conditions as they affect the vital questions of quality and quantity of materials, of character of workmanship, and of cost.

(c) **Specifications** consist of a supplementary statement in words, of at least all those items of information regarding a proposed building which are not set forth in the drawings.

(d) **Detail Drawings** include all the necessary supplementary drawings required for the use of the builders, to enable them to so provide and shape their material that it may be adjusted to its proper place or function in the building with the least delay, and the smallest chance for errors and misfits. If not prepared until after the contract for the building is let they must not impose on the contractor any labor or material which is not called for by the spirit and intent of the "General Drawings" and "Specifications."

(e) The **Supervision** of an architect (as distinguished from the continuous personal superintendence which may be secured by the employment of a clerk-of-the-works or inspector of construction) means such inspection by the architect or his deputy, of work in studios and shops or a building or other work in process of erection, completion or alteration, as he finds necessary to ascertain whether it is being executed in general conformity with his drawings and specifications or directions. He has authority to reject any part of the work which does not so conform and to order its removal and reconstruction. He has authority to act in emergencies that may arise in the course of construction, to order necessary changes, and to define the intent and meaning of the drawings and specifications. On operations where a clerk-of-the-works or inspector of construction is required, the architect shall employ such assistance at the owner's expense.

11. Drawings and specifications, as instruments of service, are the property of the architect.

12. Exceptions.

Dwellings costing less than $10,000	10%
Lofts not requiring special planning for machinery or arrangement	5%
Additions and alterations to dwellings	12%
Additions and alterations to business buildings	10%

N. B.—Above schedule is considered minimum for ordinary and usual professional service. It is not considered fair or reasonable for highly specialized service.

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LIST OF LICENSED ARCHITECTS

Members of the Profession who will be Permitted to Practice in the State of Illinois.

Every means has been used to get a correct List of Licensed Architects who will be permitted to practice Architecture in the State of Illinois for the ensuing year. The names have been compared with the records of the State Board of Examiners of Architects and agrees with the Official Records of the State of Illinois.

CHICAGO.

Adler, Abraham, K., 332 S. Michigan Ave.
Aga, Ole W., 139 N. Clark St.
Ahlschlager, John, 155 N. Clark St.
Ahlschlager, Walter W., 155 N. Clark St.
Allison, Lyman J., 109 N. Dearborn St.
Almquist, Carl M., 35 S. Dearborn St.
Alschuler, Alfred S., 28 E. Jackson Blvd.
Anderson, Helge A., 79 W. Monroe St.
Anderson, Pierce, 80 E. Jackson Blvd.
Anderson, Russell A. M., 1215-53 W. Jackson Blvd.
Andresen, Theodore, 643 Barry Ave.
Angell, Arnold A., 338 S. Kildare Ave.
Anis, Albert, 155 N. Clark St.
Ansorge, Carl T., 2011 Seminary Ave.
Armstrong, John A., 104 S. Michigan Ave.
Aroner, Jacob S., 139 N. Clark St.
Ashby, Geo. William, 237 S. Fifth Ave.
Ashby, Wilbert B., 237 S. Fifth Ave.
Awsumb, George, 14 E. Jackson Blvd.
Ayars, Charles R., 184 W. Washington St.
Bailey, Cyrus, 1710 28 E. Jackson Blvd.
Baker, Frank S., 10 S. La Salle St.
Bannister, George S., 1620 W. 102nd St.
Barfield, William G., 58 W. Washington St.
Bargman, Ewald F., 815 Addison Ave.
Barnes, Julian, 19 S. La Salle St.
Barrett, Fred L., 700-900 S. Michigan Ave.
Barthel, Julius B., 127 N. Dearborn St.
Barton, F. M., 178 W. Jackson Blvd.
Bayley, Richard W., 3258 Lexington St.
Beaudry, Ralph L., 7047 Princeton Ave.
Beaumont, George, 25 N. Dearborn st.
Beers, Herbert P., 38 S. Dearborn St.
Behel, Vernon W., 25 N. Dearborn St.
Beiler, Henry P., 3166 Lincoln Ave.
Bell, T. N., 1820 S. Spaulding Ave.
Beman, Spencer S., 332 S. Michigan Ave.
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Bennett, Wm. Arthur, 35 S. Dearborn St.
Benson, Edward, 3204 N. Clark St.
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Bessler, Edward W., 1837 W. 12th St.
Bicknell, Alfred H., 1726-38 S. Dearborn St.
Bishop, Thomas R., 35 S. Dearborn St.
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Bristle, Joseph H., 206 S. La Salle St.
Brodhag, Louis, 5311 Lakewood Ave.
Brown, Arthur G., 19 S. La Salle St.
Brown, Arthur V., 7102 Normal Ave.
Brueckner, Carl Louis, 635 Sherman St.
Brush, Charles E., 934 Graceland Ave.
Brydges, E. Norman, 64 E. Van Buren St.
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Ferree, Albert G., 304 W. 63d St.
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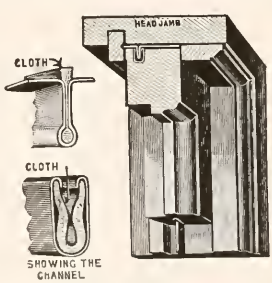

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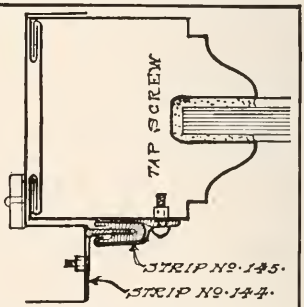

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Hoover, Ira W., 105 S. La Salle St.
Hoskins, John M., 2837 W. Madison St.
Hotchkiss, Roy J., 82 W. Washington St.
Hotton, B. J., 64 W. Randolph St.
Houda, Joseph F., 1912 S. Crawford Ave.
Huber, Julius H., 184 W. Washington St.
Huehl, Harris W., 154 W. Randolph St.
Hughes, Andrew F., 323 W. 69th St.
Hulla, John, 140 S. Dearborn St.
Hunt, Jarvis, 30 N. Michigan Ave.
Hunt, Leigh B., 332 S. Michigan Ave.
Hussander, Arthur F., Tribune Bldg.
Hussey. Harry H., 19 S. La Salle St.
Hyde, Robert M., 110 S. Dearborn St.
Hyett, Robt. Leal, 606 S. Michigan Ave.
Hyland, Paul V., 29 E. Madison St.
Ingalls, Arthur R., 7207 Yale Ave.
Jacobs, Arthur, 704 E. 50th Pl.
Jebsen, Ernest. 64 W. Randolph St.
Jenkins. A. D., 1401-39 S. La Salle St.
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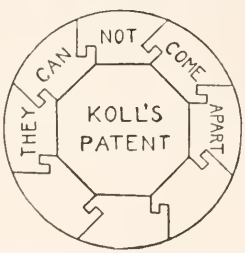

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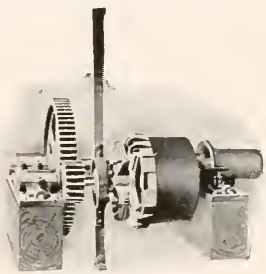

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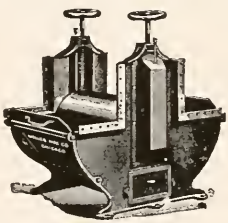

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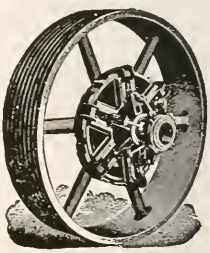

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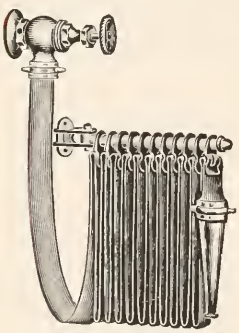

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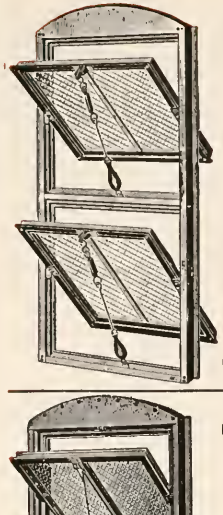

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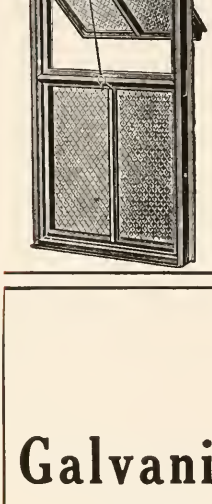

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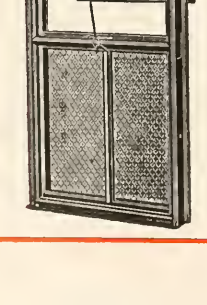

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Puckey, F. W., 1614-134 S. La Salle St.
Sullivan, Louis H., 1600-431 S. Mich. Ave.
Taft, Lorado, 410 S. Michigan Ave.
Wagner, Fritz, 80 E. Jackson Blv.

CITY OFFICIALS

CARTER H. HARRISON	Mayor.
CHARLES C. FITZMORRIS	Secretary to the Mayor.
JAMES A. QUINN	Oil Inspector.
PETER ZIMMER	CITY Sealer.
JOHN E. TRAEGER	City Comptroller.
LOUIS E. GOSSELIN	Deputy City Comptroller.
L. E. McGANN	Commissioner of Public Works.
MICHAEL J. FLYNN	City Treasurer.
FRANCIS D. CONNERY	City Clerk.
EDWARD J. PADDEN	Chief Clerk, City Clerk's Office.
RAY PALMER	City Electrician.
FRANCIS OWENS	Track Elevation Expert.
RICHARD J. REYNOLDS	Department of Supplies.
EDWARD COHEN	City Collector.
J. F. McCARTY	Deputy City Collector.
DR. G. B. YOUNG	Health Department.
DR. GOTTFRIED KOEHLER	Asst. Comr. of Health.
DR. HERMAN SPAULDING	Chief Medical Inspector.
FRANK W. SOLON	Acting Superintendent of Streets.
HARMON M. CAMPBELL, Prest.	Civil Service Commission.
ELTON LOWER	
JOHN J. FLYNN	
R. A. WIDDOWSON	Secretary, Civil Service Commission.
HENRY ERICSSON	Building Commissioner.
JAMES GLEASON	Chief of Police.
HERMAN F. SCHUETTLER	1st Deputy Sup't of Police.
M. L. C. FUNKHOUSER	2nd Deputy Sup't of Police.
PHILIP R. CRIPPEN	Department Inspector.
WILLIAM H. SEXTON	Corporation Counsel.
N. L. PIOTROWSKI	City Attorney.
JAMES S. McINERNEY	City Prosecutor.
JOHN D. RILEY	Map Department.
FRANCIS A. EASTMAN	City Statistician.
PATRICK WHITE	Superintendent of Bridges.
DR. JOHN D. McGREGOR	City Physician.
DR. CLARA P. SEIPPEL	Asst. City Physician.
WILLIAM J. McCOURT	Superintendent, Bureau of Water.
OSBORN MONNET	Smoke Inspector.
HENRY A. ZENDER	Board of Examining Engineers.
ADOLPH W. JANCZEWSKY	
W. F. MELICAN	
JOHN J. HALPIN	Chief Detective Bureau.
MICHAEL J. RYAN	Inspector of Steam Boilers and Steam Plants.
N. E. MURRAY	Superintendent of Sidewalks.
CHARLES B. BALL	Chief of Sanitary Bureau.
EDWARD PRITCHARD	Secretary, Health Department.
SIMON MAYER	Secretary of Police.
JOHN ERICSON	City Engineer.
GEORGE A. SCHILLING	Board of Local Improvements.
CLAYTON F. SMITH	
FRED BURKHARD	
FRANK RYDZEWSKI	
FRANK SIMA	
EDWARD J. GLACKIN	Secretary of Board of Local Improvements.
THOS. O'CONNOR	Fire Marshal.
GEO. E. McGRATH	Asst. Supt. of Sewers.
HENRY E. LEGLER	Librarian.
HENRY D. CAPITAIN	Acting Chairman, Special Park Commission.
JACOB PROST	City Forester.
HENRY D. McGURN	Supt., Bureau of Compensation.
JOHN L. WHITMAN	Supt. House of Correction.
CHARLES W. KALLAL	City Architect.
LEONORA Z. MEDER	Supt. of Public Welfare.
MONTIGUE FERRY	Supt. of Public Service.

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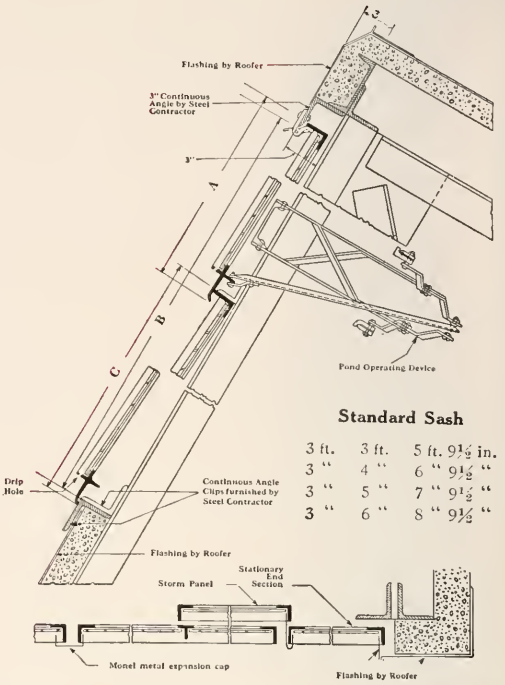
Provides continuous ventilation when equipped with Pond-Operating Device. Sash is weathertight when open. Being provided with storm panels it forms a complete watershed.

All joints in sash are welded by oxy-acetylene process. Sections are heavy solid steel members.



Standard Sash

3 ft.	3 ft.	5 ft. 9½ in.
3 "	4 "	6 " 9½ "
3 "	5 "	7 " 9½ "
3 "	6 "	8 " 9½ "

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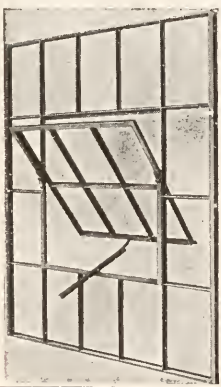

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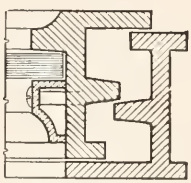

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In solid rolled steel and drawn bronze. Leaded glass and casement hardware. All casement windows can be adopted to suit various styles of architecture. Windows hinged in pairs to swing inward with hinged transoms divided into small glass panes by metal muntins, prepared with steel anchors for building into masonry. Trim in baked enamel suited to all colors.

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TAXES: When and Where to Pay.

GENERAL TAXES: State, County and City.

Annually at **County Treasurer's Office,** County Building, 1st floor, north end. Must be paid before May 1 of each year. Failure to pay before May 1 means a penalty of one (1%) per cent per month until sold. (Then heavier penalty; and trouble.)

SPECIAL ASSESSMENTS: (Street Paving, Water Pipes, Etc.).

Before March 10, at City Collector's Office, City Hall, 1st floor, south end.
After April 1, at County Treasurer's Office, County Building, 1st floor, north end.

WATER TAX:

At Bureau of Water, City Hall, 1st floor, north end.

DOG TAX:

City Hall, 1st floor, south end.

OFFICES—NEW CITY HALL.

Architect, City, 10th floor, south end.
Bailiff, Municipal Court, 8th floor, north end.
Board of Election Commissioners, 3rd floor, south end.
Board of Examiners:
- Motor Vehicle Operators, 10th floor, north end.
- Moving Picture Operators, 10th floor, north end.
- Plumbers, 10th floor, north end.
- Stationary Engineers, 10th floor, north end.

Board of Inspectors of Public Vehicles, 3rd floor, north end.
Board of Local Improvements:
- General Offices, 2nd floor, south end.
- Public Hearing Room, 1st floor, north end.
- Law Department, 2nd floor, south end.

Boiler Inspection, 6th floor, south end.
Buildings, Department of, 7th floor, north end.
Bridge Division, 4th floor, north end.
Business Agent, vault floor, north end.
Chief Justice Municipal Court, 9th floor, south end.
City Attorney, 6th floor, north end.
City Clerk, 1st floor, south end.
City Collector, 1st floor, south end.
City Comptroller (5th floor, north end):
- General Office.
- Auditor.
- Paymaster.
- Real Estate Agent.

City Council:
- Council Chamber, 2nd floor, north end.
- General Committee Rooms, 2nd floor, north end.
- Committee on Finance, 2nd floor, north end.
- Committee on Local Transportation, 3rd floor, north end.
- Commission, Special Park, 10th floor, north end.

City Electrician, 6th floor, center.
City Forester, 10th floor, north end.
City Hall:
- Superintendent, 3rd floor, north end.
- Chief Janitor, 3rd floor, north end.

City Sealer, vault floor, south end.
City Statistician, 10th floor, north end.
City Treasurer, 2nd floor, center.
Civil Service Commission:
- General Offices, 6th floor, south end.
- Examining Room, 10th floor, center.

Clerk, City, 1st floor, south end.
Clerk, Municipal Court, 8th floor, south end.
Committee Rooms, City Council, 2nd floor, north end.
Compensation, Bureau of, vault floor, south end.
Corporation Counsel, 5th floor, south end.
Engineering, Bureau of (City Engineer), 4th floor, north end.
Election Commissioners, Board of, 3rd floor, south end.
Electricity, Department of, 6th floor, center.
Finance Committee, 2nd floor, north end.
Fire Department:
- Fire Marshal, 1st floor, north end.
- Fire Alarm Telegraph, 6th floor, center.
- Firemen's Pension Fund, Secretary of Board of Trustees (City Clerk), 1st floor, south end.

Gas Inspector, Bureau of, vault floor, south end.
Harbor Division, 4th floor, north end.
Health, Department of, 7th floor.
- Commissioner of Health.
- Bureau of Food Inspection.
- Bureau of Sanitary Inspection.
- Bureau of Contagious Diseases.
- Bureau of Vital Statistics.

Law, Department of:
- Corporation Counsel, 5th floor, south end.
- City Attorney, 6th floor, north end.
- Prosecuting Attorney, 6th floor, north end.
- Special Assessment Attorney, 2nd floor, south end.

Local Transportation, Committee on, 3rd floor, north end
Local Transportation, Department of (Traction Expert), 3rd floor, north end.
Maps and Plats, Bureau of, 4th floor, south end.
Mayor's Office, 5th floor, center.
Motor Vehicle Operators, Board of Examiners, 10th floor, north end.
Moving Picture Operators, Board of Examiners, 10th floor, north end.
Municipal Court:
- Chief Justice, 9th floor, south end.
- Bailiff, 8th floor, north end.
- Clerk, 8th floor, south end.
- Court Rooms, 8th, 9th and 11th floors.

Oils, Inspector of, 10th floor, south end.
Police Department:
- General Superintendent, 5th floor, north end.
- Assistant General Superintendent, 3rd floor, center.

Plumbers, Board of Examiners of, 10th floor, north end.
Prosecuting Attorney, 6th floor, north end.
Public Works:
- Commissioner, 4th floor, center.
- Bureau of Engineering, 4th floor, north end.
- Bridge Division, 4th floor, north end.
- Harbor Division, 4th floor, north end.
- Bureau of Maps and Plats, 4th floor, south end.
- Bureau of Sewers, 4th floor, south end.
- Bureau of Streets, 4th floor, south end.
- Bureau of Water, 1st floor, north end.
- Water Pipe Extension Division, 4th floor, north end.

Sanitary Inspection, Bureau of, 7th floor, center.
Sewers, Bureau of, 4th floor, south end.
Smoke Inspection, Department of, 6th floor, south end.
Special Assessments (Board of Local Improvements), 2nd floor, south end.
Special Assessments (Law Department), 2nd floor, south end.
Special Park Commission:
- Secretary, 10th floor, north end.
- City Forester, 10th floor, north end.

Stationary Engineers, Board of Examiners of, 10th floor, north end.
Statistician, City, 10th floor, north end.
Steam Boilers and Steam Plants, Department of Inspection of, 6th floor, south end.
Streets, Bureau of, 4th floor, south end.
Supplies, Department of (Business Agent), vault floor, north end.
Track Elevation, Department of, 10th floor, north end.

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Spirals	**Wire Mesh**	**Corner Beads and Curbs**
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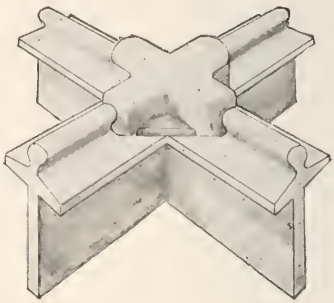
We keep a large and complete stock in the heart of Chicago ready for prompt delivery. Our power benders can handle this stock rapidly and accurately and we have excellent shipping facilities on the grounds.

Monad Steel Sash



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All details of this sash are given careful mechanical and engineering attention and embody the mature results of this attention.

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For every kind of movable window we have evolved an efficient operating device. We manufacture torsion, straight pull and rack and pinion types, and all are well fabricated and neat in appearance.

We solicit the work of supplying Sash Glazed and Erected with Operating Devices.

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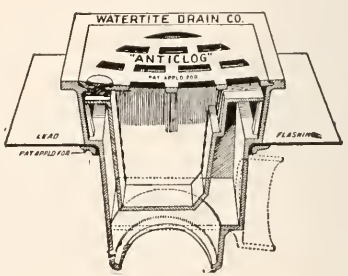
For Warehouses, Factories, Mills, Lofts, Storage Buildings, etc. To secure maximum protection against Fire and Water loss at lowest insurance rate.

Useful Data for Architects, Engineers and Builders.

As Scuppers generally pay for themselves in **reduced insurance** within one year, it is clear that it pays to put in a good and durable Scupper at the start.



SPECIFICATION—Furnish and set in the walls at every floor above basement, and where indicated on plans, UNDERWRITER HOODED SCUPPERS as made by the Watertite Drain and Scupper Co., Inc., 71-73 Murray Street, New York. Area of outlet to be not less than 16, and of inlet not less than 40 square inches. To be standard shape (or brick shape), of cast iron, with bronze metal valve at outer end hinged with copper pin and babbitted to prevent corrosion. Valve and hinge protected by a cast iron (or bronze metal) hood. All iron parts to be painted with iron preservative paint (or galvanized).

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Traction Expert, 3rd floor, north end.
Treasurer, City, 2nd floor, center.
Vehicles, Board of Inspectors of, 3rd floor, north end.
Water, Bureau of, 1st floor, north end.
Water Pipe Extension Division, 4th floor, north end.
Weights and Measures, Department of, vault floor, south end.

OFFICES—COUNTY BUILDING.

AUDITOR:
R. 512, 5th floor.

BOARD OF ASSESSORS:
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Michael Sheridan.
David M. Pfaelzer.
Adam Wolf.
Frank W. Koraleski, Secretary.
R. 312, 3rd floor.

BOARD OF REVIEW:
Roy O. West, President.
Fred W. Blocki, Secretary.
Thomas J. Webb.
R. 337, 3rd floor.

CIRCUIT COURT:

Clerk:
John W. Rainey.
R. 512, 4th floor.

Judges:
Hon. John Gibbons.
Hon. George Kersten.
Hon. Richard S. Tuthill.
Hon. Kickham Scanlan.
Hon. Frederick A. Smith.
Hon. Merritt W. Pinckney.
Hon. Lockwood Honore.
Hon. Charles M. Walker.
Hon. Edward O. Brown.
Hon. Thomas G. Windes.
Hon. Adelor J. Petit.
Hon. Jesse A. Baldwin.
Hon. Frank Baker.

CIVIL SERVICE COMMISSION:
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Anna E. Nichols, Secretary.
W. Francis Corby.
R. 547, 5th floor.

CLERK, COUNTY:
Robert M. Sweitzer.
R. 233, 2nd floor.

COMPTROLLER, DEPUTY COUNTY:
Frank S. Ryan.
R. 511 5th floor.

CORONER:
Peter M. Hoffman.
R. 500, 5th floor.

COUNTY ATTORNEY:
Carl R. Chindblom.
R. 507, 5th floor.

COUNTY CLERK:
Robert M. Sweitzer.
R. 233, 2nd floor.

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From City of Chicago:
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A. M. Anderson.*
Ellsworth Board.*
John J. Gard.*
John E. Maloney.
Frank Ragen.
Joseph M. Fitzgerald.
Bartley Burg.
Stanley Kuflewski.
Daniel J. Harris.
Avery Coonley.
Daniel Moriarty.
Harley B. Mitchell.*
Albert Nowak.
*From outside of City.
Robert M. Sweitzer, Clerk.
R. 537, 5th floor.

COUNTY COURT:
Hon. John E. Owens, Judge.
R. 602, 6th floor.
Robert M. Sweitzer, Clerk.
R. 600, 6th floor.

COUNTY SUPERINTENDENT OF SCHOOLS:
Edward J. Tobin.
R. 546, 5th floor.

COUNTY TREASURER:
Wm. L. O'Connell.
Office, R. 212, 2nd floor.
General Office, 1st floor, north end.

CUSTODIAN, COUNTY BUILDING:
R. 226, 2nd floor.

JURY COMMISSIONERS:
W. A. Amberg, President.
Jos. H. Barnett
Richard J. Finnegan.
R. 824, 8th floor.

PROBATE COURT:
R. 643, 6th floor.
John A. Cervenka, Clerk.
R. 623, 6th floor.

RECORDER OF DEEDS:
Joseph F. Connery.
1st floor, south end.

REGISTRAR OF TITLES (Torrens System):
Joseph F. Connery.
1st floor, south end.

REVIEW, BOARD OF:
R. 337, 3rd floor.

SHERIFF:
Michael Zimmer.
R. 423, 4th floor.

SUPERIOR COURT:

Judges:
Hon. Theodore Brentano.
Hon. Albert C. Barnes.
Hon. Marcus A. Kavanagh.
Hon. Ben M. Smith.
Hon. Wm. H. McSurely.
Hon. Chas. A. McDonald.
Hon. Wm. E. Dever.
Hon. Richard E. Burke.
Hon. Joseph H. Fitch.
Hon. Thomas C. Clark.
Hon. Wm. F. Cooper.
Hon. Martin M. Gridley.

Clerk:
Richard J. McGrath.
R. 437, 4th floor.

SUPERINTENDENT OF PUBLIC SERVICE:
Robert E. Kenyon.
R. 519, 5th floor.

SUPERINTENDENT OF SCHOOLS (COUNTY):
Edward J. Tobin.
R. 506, 5th floor.

SURVEYOR:
Geo. C. Waterman.
R. 1026, 10th floor.

TORRENS SYSTEM:
Joseph F. Connery, Registrar.
1st floor, south end.

TREASURER, COUNTY:
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General Offices, 1st floor, north end.

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The only system that is kept alphabetically correct, lettering uniform, correctly spaced and perfectly aligned.

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cannot be held open to waste water—do not require regulating—are suitable for either direct or tank supply and plumbing fixtures of any manufacture.

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ILLINOIS STATE DEPARTMENT

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BUILDING ORDINANCE

OF THE CITY OF CHICAGO

Passed by the City Council December 5, 1910.

Comprising Sections 199 to 727, inclusive.

EFFECTIVE JANUARY 9, 1911.

All amendments up to July 30, 1914, will be found printed in italics under proper Section numbers, except the Fire Limits Ordinance. (Section 718.) A star ★ marks all amended sections.

Attention is called to the several new ordinances following the building ordinance, having to do, or in connection with the erection or location of buildings.

AN ORDINANCE.

Relating to buildings within the City of Chicago.

Be it ordained by the City Council of the City of Chicago:

Section 1. That there is hereby added to the Revised Municipal Code of Chicago of 1905 a new Chapter to be known as Chapter XV, which shall read as follows:

CHAPTER XV.

ARTICLE I.

Buildings.

*199. **Department of Buildings Established—Officers.)** There is hereby established an executive department of the municipal government of the City of Chicago which shall be known as the Department of Buildings and which shall embrace a Commissioner of Buildings, a Deputy Commissioner of Buildings, an Engineer in charge, a Building Inspector in charge, an Elevator Inspector in charge, a Fire Escape Inspector in charge, a Secretary to the Commissioner of Buildings and such *number of Assistant Engineers in charge, Assistant Building Inspectors in charge, Building Inspectors, Elevator Inspectors, Fire Escape Inspectors and such other officers, assistants and employes as may be from time to time provided for in the annual appropriation ordinance.*

*Amended May 27, 1912.

*200. **Building Commissioner—Appointment—Bond—Other Officers—Offices Created.)** (a) There is hereby created the office of Commissioner of Buildings. He shall be the head of said department of buildings and shall be an experienced architect, or a civil, structural or architectural engineer or a building contractor or an efficient building mechanic and shall have been engaged as an architect or a civil, structural or architectural engineer or building contractor or building mechanic for a period of not less than ten years prior to his appointment; and during his term of office as Commissioner of Buildings he shall not be engaged in any other business.

(b) He shall be appointed by the Mayor, by and with the advice and consent of the City Council.

(c) The Commissioner of Buildings before entering upon the duties of his office shall execute a bond to the city in the sum of twenty-five thousand dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of his duties as the Commissioner of Buildings.

(d) *There are hereby created the offices of Deputy Commissioner of Buildings, Engineer in charge, Building Inspector in charge, Elevator Inspector in charge, Fire Escape Inspector in charge, Secretary to the Commissioner of Buildings, Assistant Engineer in charge and of such number of Assistant Building Inspectors in charge, Building Inspectors, Elevator Inspectors and Fire Escape Inspectors as may be from time to time provided for in the annual appropriation ordinance. The incumbents of these offices shall be known and designated by their respective titles as herein set forth.*

*Amended May 27, 1912, by adding ¶(d).

*200½. **Powers—Appointment of Subordinates—Duties of Commissioner.)** (a) He shall have the management and control of all matters and things pertaining to the department of buildings, and shall appoint, and may remove according to law, all subordinate officers and assistants in his department. All subordinate officers, assistants, clerks and employes in said department shall be subject to such rules and regulations as shall be prescribed from time to time by said commissioner.

(b) The Commissioner of Buildings shall institute such measures and prescribe such rules and regulations for the control and guidance of his subordinate officers and employes as shall secure the careful inspection of all buildings which in process of construction, alteration, repair or removal and the strict enforcement of the several provisions of this chapter.

(c) It shall be the duty of said commissioner and his assistants to enforce all ordinances relating to the erection, construction, alteration, repair, removal or the safety of buildings.

(d) *In all cases where any action is taken by the Commissioner of Buildings to enforce the provisions of any of the sections continued in this chapter or to enforce the provisions of any of the building ordinances of the city now or at any time hereafter in force, whether such action is taken in pursuance of the express provisions of such sections or ordinances or in a case where discretionary power is given by the ordinances of said city to the Commissioner of Buildings, such acts shall be done in the name of and on behalf of the City of Chicago, and the said Commissioner of Buildings in so acting for the city shall not render himself liable personally, and he is hereby relieved from all personal liability, for any damage that may accrue to persons or property as a result of any such act permitted in good faith in the discharge of his duties, and any suit brought against the said Commissioner of Buildings by reason thereof shall be defended by the Department of Law of said city until the final termination of the proceedings therein.*

*Amended Dec. 18, 1911, by adding ¶(d).

(d) 201. **Inspection of all Buildings in General Use—Precautions in Behalf of Public Safety—May Require Repair or Alteration in Such Cases—Interpretation of this Chapter.** (a) The Commissioner of Buildings shall inspect or cause to be inspected all

public school buildings, public halls, churches, theaters, buildings used either for manufacturing or commercial purposes, hotels, apartment houses and other buildings or structures occupied or frequented by large numbers of people, for the purpose of determining the safety of such buildings, or any parts or appliances or equipment thereof; the sufficiency of their doors, passageways, aisles, stairways, corridors, exits or fire escapes and generally their facilities for egress in case of fire or other accidents, and the strength of their floors, and he shall make return of all violations of the several provisions of this chapter to the Law Department for prosecution.

(b) It shall be the duty of the Commissioner of Buildings, when any citizen represents that combustible materials are kept in any place in the city in an insecure manner, or that the doors, stairways, corridors, exits or fire escapes in any factory or workshop or other place of employment are insufficient for the escape of employes in case of fire, panic or accident, or do not comply with the provisions of this Chapter; or that the funnels, flues, fire boxes, or heating apparatus in any building in the city are insecure or dangerous, or that any part of any building in the city is in an unsafe or dangerous condition or in any wise in contravention of this Chapter, to make an examination of such place or building, and if such representation is found to be true, said Commissioner shall give notice in writing to the owner, occupant, lessee, or person in possession, charge or control of such place or building to make such changes, alterations or repairs as safety or the ordinance of the City may require. Upon failure of parties so notified to comply with said notice the matter shall be placed in the Law Department for prosecution.

(c) It shall be unlawful to continue the use of such building until the changes, alterations or repairs found necessary by the Commissioner of Buildings to make such building or part thereof safe or to bring it into compliance with this Chapter, shall have been made.

(d) The Commissioner of Buildings shall have full power to pass upon any question arising under the provisions of this chapter, subject to the conditions, modifications, and limitations contained therein.

202. **Buildings Found in Unsafe Condition—Notice to Owner—Authority of Commissioner.)** (a) Whenever the Commissioner of Buildings shall find any building, or structure or part thereof in the city in such an unsafe condition as to endanger life but in such condition that by the immediate application of precautionary measures such danger may be averted, he shall have authority, and it shall be his duty, to forthwith notify, in writing, the owner, agent or person in possession, charge or control of such building or structure or part thereof, to adopt and put into effect such precautionary measures as may be necessary or advisable in order to place such building or structure or part thereof in a safe condition; such notice shall state briefly the nature of the work required to be done and shall specify the time within which the work required to be done shall be completed by the person, firm or corporation notified, which shall be fixed by said Commissioner of Buildings, upon taking into consideration the condition of such building or structure or part thereof, and the danger to life or property which may result from its unsafe condition.

(b) Whenever such Commissioner of Buildings shall be unable to find the owner of such building, structure or part thereof, or any agent or person in possession, charge or control thereof, upon whom such notice may be served, he shall address, stamp and mail such notice to such person or persons at their last known address, and in addition thereto shall place or cause to be placed the notice herein provided for upon such building at or near its principal entrance, and shall also post or cause to be posted in a conspicuous place at each entrance to such building, in large letters, a notice as follows:

"THIS BUILDING IS IN A DANGEROUS CONDITION AND HAS BEEN CONDEMNED BY THE COMMISSIONER OF BUILDINGS."

(c) It shall be unlawful for any person, firm or corporation to remove said notice or notices without written permission from the Commissioner of Buildings.

(d) If at the expiration of the time specified in such notice for the completion of the work required to be done by the terms of such notice, in order to render the building or structure safe, said notice shall not have been complied with, and said building or structure is in such an unsafe condition as to endanger life or property, it shall be the duty of the Commissioner of Buildings to proceed forthwith to tear down or destroy that part of said building or structure that is in such unsafe condition as to endanger life or property, and in cases where an unsafe building or structure cannot be repaired or rendered safe by the application of precautionary measures, such building or structure, or the dangerous parts thereof, shall be torn down by said Commissioner of Buildings or by his order and the expense of tearing down any part of such building or structure shall be charged to the person owning or in possession, charge or control of such building or structure or part thereof, and the said commissioner shall recover or cause to be recovered from such owner or person in possession, charge or control thereof the cost of doing such work, by legal proceedings prosecuted by the Law Department.

(e) If the owner, agent or person in possession, charge or control of such building or structure, or part thereof, when so notified, shall fail, neglect or refuse to place such building or structure, or part thereof, in a safe condition, and to adopt such precautionary measures as shall have been specified by said commissioner within the time specified in such notice, in such case, at the expiration of such time it shall be unlawful for any person, firm or corporation to occupy or use said building or structure, or any part thereof, until said building or structure or part thereof is placed in a safe condition; and in case where a building or structure, or part thereof, is in a dangerous or unsafe condition and has not been placed in a safe condition within the time specified in the notice of the Commissioner of Buildings, such building or structure, or such part thereof, shall be forthwith vacated, and it shall be unlawful for any person or persons to enter same except for the purpose of making repairs required by the Commissioner of Buildings and the ordinances of the City of Chicago.

203. **Building or Part of Building Constructed or Being Constructed in Violation of Chapter—Authority of Commissioner to Tear Down.)** (a) Whenever it shall be found that any building or structure, or part thereof, is being, or shall have been constructed or built in violation of any of the provisions of this chapter, the Commissioner of Buildings shall forthwith notify the owner, agent, superintendent or architect of, or the contractor engaged in erecting such building or structure, or part thereof, of the fact that such building or structure, or part thereof, has been, or is being, constructed or erected contrary to the provisions of this chapter and shall specify briefly in such notice in what manner the provisions of this chapter or any of them, have been violated, and shall re-

quire the person so notified to forthwith make such building, structure, or part thereof, conform to and comply with the provisions of this chapter, specifying in such notice the time within which such work shall be done.

(b) If, at the expiration of the time set forth in such notice, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and to have such building or structure, or part thereof, concerning which notice was sent, changed so as to conform to and comply with the provisions of this chapter, the Commissioner of Buildings shall have the authority, and it shall be his duty to proceed forthwith to tear down or cause to be torn down such building or structure, or such part thereof as shall or may have been erected and constructed in violation of the provisions or any of the provisions of this chapter, and the cost of such work shall be charged to and recovered from the owner of such building or structure or from the person for whom such building or structure is being erected, in legal proceedings prosecuted by the Law Department.

204. **May Direct Fire Department to Remove.)** The Commissioner of Buildings shall have authority to direct the Fire Marshal to tear down any defective or dangerous wall or structure or any building or structure or part thereof which may be constructed in violation of the terms of this chapter, after written notice has been served upon the owner, lessee, occupant, agent or person in possession, charge or control, directing him or them to tear down or remove any defective wall, building or structure, or any part thereof, which is in a dangerous condition, which has been, or is being, constructed or maintained in violation of the terms of this chapter. In case of the destruction or partial destruction of buildings by fire, decay or otherwise, when any department of the city government, pursuant to the ordinances of the city, shall make an outlay of money or incur any liability for the payment of any expense on behalf of the city in an effort to preserve or prevent the destruction of such building or buildings, or structure, or for the preservation of life of its citizens, it shall be the duty of the Commissioner of Buildings to ascertain the amount of such outlay or expenditure and present a bill therefor to the owner or owners of any such building or buildings, or its or their agent or agents, and it shall be the duty of said Commissioner of Buildings to refuse to issue a permit for the construction, re-construction, alteration or repair of any building or buildings or structure by any such owner or owners, lessee, occupant, agent or person in possession, charge or control thereof until such outlay or expenditure shall be repaid to the city by the owner, lessee, occupant, agent or person in possession, charge or control of such building or buildings thus totally or partially destroyed in the manner aforesaid. Said commissioner shall also proceed forthwith to collect the amount of such bill from such owner or owners, by legal proceedings prosecuted by the Law Department.

205. **May Stop Construction and Wrecking of Buildings.)** (a) Said commissioner shall have power to stop the construction of any building or the making of any alterations or repairs of any building within said city when the same is being done in a reckless or careless manner or in violation of any ordinance, and to order, in writing or by parole, any and all persons in any way or manner whatever engaged in so constructing, altering or repairing any such building, to stop and desist therefrom.

(b) And the said commissioner shall have power to stop the wrecking or tearing down of any building or structure within said city when the same is being done in a reckless or careless manner or in violation of any ordinance or in such a manner as to endanger life or property, and to order any and all persons engaged in said work to stop and desist therefrom. When such work has been stopped by the order of said commissioner, it shall not be resumed until said commissioner shall be satisfied that adequate precautions will be taken for the protection of life and property, and that said work will be prosecuted carefully and in conformity with the ordinances of the city.

206. **Arbitration—Appeal from Decision.)** (a) In all cases where discretionary power is given to the Commissioner of Buildings to estimate damage to buildings, as also in questions relating to the security of any building or buildings or structures, or part thereof, and in all other cases where discretionary powers are given by ordinance to the Commissioner of Buildings, any party or parties believing themselves injured or wronged by the decision of the Commissioner of Buildings must, before instituting any suit, make an appeal for arbitration as follows, to-wit:

(b) Any person wishing to make an appeal shall do so within five days after written notice of the decision or order of the Commissioner of Buildings has been given. An appeal made later than five days after the serving of the notice of the Commissioner of Buildings shall not entitle the appellant to any arbitration. The request for arbitration shall be in writing and shall state the object of the proposed arbitration and the name of the person who is to represent the appellant as arbitrator.

(c) The Commissioner of Buildings shall thereupon inform the appellant of the cost of such arbitration and such appellant shall, within twenty-four hours from the receipt of such information, deposit with the Commissioner of Buildings the sum of money requested for defraying the expense of the same, which sum shall be fixed in each case by said commissioner in proportion to the time it will take and the difficulty and importance of the case, but shall in no case be more than the cost of similar service in the course of ordinary business of private individuals or corporations. As soon as such sum of money shall have been deposited with him, the Commissioner of Buildings shall appoint an arbitrator to represent the city and the two arbitrators thus chosen shall, if they cannot agree, select a third arbitrator, and the decision of any two of these arbitrators shall, after investigation and consideration of the matter in question, be final and binding upon the appellant as well as the city unless an appeal is taken therefrom, as provided in case of an appeal under a statutory arbitration, within five days thereafter.

207. **Arbitrators to Take Oath—Power to Examine Witnesses.)** The arbitrators shall themselves, before entering upon the discharge of their duties, be placed under oath by the City Clerk, to the effect that they are unprejudiced as to the matter in question and that they will faithfully discharge the duties of their position. They shall have the power to call witnesses and place them under oath, and their decision or award shall be rendered in writing, both to the Commissioner of Buildings and to the appellant. The fee deposited by the appellant with the Commissioner of Buildings shall be paid by the Commissioner of Buildings to the arbitrators upon the rendering of their report and shall be in full of all costs incident to the arbitration; but should the decision of said board of arbitration be rendered against the Commissioner of Buildings, then the money deposited by the

aforesaid appellant shall be returned to him and the entire cost of such arbitration shall be paid by the city.

208. **In Urgent Cases—Commissioner's Power Final.)** Whenever the decision of the Commissioner of Buildings upon the safety of any building or any part thereof is made in a case which is so urgent that failure to properly carry out his orders to demolish or strengthen such building or part thereof may endanger life and limb, the decision and order of the Commissioner of Buildings shall be absolute and final.

209. **Duty of Police to Assist Commissioner in Enforcing Provisions of this Chapter.)** Whenever it shall be necessary, in the opinion of the Commissioner of Buildings, to call upon the Department of Police for aid or assistance in carrying out or enforcing any of the provisions of this chapter, he shall have the authority so to do, and it shall be the duty of the Department of Police, or of any member of said department, when called upon by said commissioner, to act according to the instructions of, and to perform such duties as may be required by said commissioner in order to enforce or put into effect the provisions of this chapter.

210. **Certificates—Notices—Register.)** (a) The Commissioner of Buildings shall sign or cause to be signed all certificates and notices required to be issued from the Department of Buildings and shall keep a record of the same, and shall issue or cause to be issued all permits authorized by this chapter.

(b) He shall also keep a proper record of all transactions and operations of the department and such record shall be at all times open to the inspection of the Mayor, Comptroller, Superintendent of Police, Fire Marshal and members of the City Council.

211. **Must Keep Account of Fees Paid—Annual Reports and Estimates.)** (a) Said commissioner shall keep in proper books for that purpose an accurate account of all fees charged, giving the name of person to whom same is charged, date on which said charge is made, and the amount of each such fee.

(b) He shall also, annually, on or before the first day of February in each year prepare and present to the City Council a report showing the receipts and expenditures and entire work of the Department of Buildings during the previous fiscal year and he shall on or before November first of each year prepare and submit to the Comptroller an estimate of the whole cost and expense of providing for and maintaining his office during the ensuing fiscal year.

212. **Examination and Approval of Plans —Record of Inspections and Complaints.)** The Commissioner of Buildings and his assistants shall pass upon all questions relating to the strength and durability of buildings or structures; shall examine and approve all plans before a permit is issued for the construction of any building or structure. The Commissioner of Buildings shall cause to be kept a complete record showing the location and character of every building or other structure for which a permit is issued and shall cause to be filed every report of inspection made on such building, which reports shall bear the signatures of the inspectors making such inspections. He shall cause to be kept a record of all complaints of violations of the building laws and shall cause all such complaints to be investigated.

*213. **Deputy Commissioner of Buildings —Duty.)** (a) There is hereby created the office of Deputy Commissioner of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this office shall be either a civil, structural or architectural engineer or an architect, an experienced building contractor or an efficient building mechanic with at least five years' experience and training.

(b) The Deputy Commissioner of Buildings shall act as Commissioner of Buildings in the absence of the Commissioner of Buildings from his office and while so acting shall discharge all the duties and possess all the powers imposed upon or vested in the Commissioner of Buildings.

(c) The deputy commissioner of buildings shall, under the direction of the Commissioner of Buildings, have general control of all matters and things pertaining to the work of the Department of Buildings and shall perform such other duties as may be required of him by the Commissioner of Buildings.

*Amended February 20, 1911.

214. **Engineer in Charge—Duties.)** (a) There is hereby created the office of Engineer in Charge, of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this position shall be a civil, structural, or architectural engineer of at least five years' experience and training.

(b) The Engineer in Charge shall be in immediate charge of the engineering work and staff of the Department of Buildings. The examination of plans submitted for the purpose of obtaining a permit, except as to matters elsewhere expressly assigned by law to some other department of the city government, shall be the duty of the Engineer in Charge and the engineering staff under his charge. The approval and stamp of the Engineer in Charge shall be required on the plans for the erection, enlargement, alteration, repair or removal of every building before a permit for such erection, enlargement, alteration, repair or removal shall be issued. The Engineer in Charge shall have charge of all tests of materials and systems of construction submitted for the approval of the Commissioner of Buildings. The Engineer in Charge shall pass upon the number, location, width and design of all fire-escapes required for new buildings, and he shall also pass upon the number, location, width and design of fire-escapes to be erected on existing buildings wherever such existing buildings are being enlarged, altered or remodeled under a building permit issued for such enlargement, alteration or remodeling. He shall perform such other duties as may be required of him by the Commissioner of Buildings.

215. **Assistant Engineer in Charge—Duties.)** (a) There is hereby created, the office of Assistant Engineer in Charge, of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this position shall be a civil, structural or architectural engineer of at least five years experience and training.

(b) In the absence of the Engineer in Charge, the Assistant Engineer in Charge shall act as Engineer in Charge. The Assistant Engineer in Charge shall perform such other duties as may be required of him by the Engineer in Charge.

216. **Engineering Staff.)** (a) The Commissioner of Buildings shall appoint according to law at least four Architectural Engineers, and such other engineers and assistants as the City Council may by ordinance provide, for service on the engineering staff of the Department of Buildings. Every person certified to fill the position of Architectural Engineer shall be a civil, structural or architectural engineer of at least five years' training and experience.

(b) The Architectural Engineers shall, under the direction of the Engineer in Charge, examine all plans submitted for the

purpose of obtaining a permit. They shall also examine and verify the figures on all floor load placards before such placards are approved for posting. They shall perform such other duties as may be required of them by the Engineer in Charge.

217. **Building Inspector in Charge—Duties.)** (a) The office of Assistant Deputy Commissioner of Buildings is hereby abolished and in lieu thereof there is hereby created the office of Building Inspector in Charge of the Department of Buildings. He shall be appointed by the Commissioner of Buildings according to law. The person certified to fill this position shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction.

(b) In the absence of the Commissioner of Buildings and the Deputy Commissioner of Buildings from their offices the Building Inspector in Charge shall act as Commissioner of Buildings, and while so acting he shall discharge all of the duties and possess all of the powers imposed upon or vested in the Commissioner of Buildings.

(c) He shall have immediate charge of the periodical inspection of buildings and of the inspection of buildings and structures being erected, enlarged, altered or repaired, excepting only such inspection as is expressly assigned to the elevator or fire-escape inspectors or is by law assigned to some other department of the city government.

218. **Assistant Building Inspectors In Charge.)** (a) The Commissioner of Buildings shall appoint, according to law, at least four Assistant Building Inspectors in Charge.

(b) Every person certified to fill the position of Assistant Building Inspector in Charge shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction. The Assistant Building Inspectors in Charge shall have immediate charge of the several districts assigned to them by the Commissioner of Buildings and shall perform such other duties as the Commissioner of Buildings shall require them.

219. **Building Inspectors.)** (a) The Commissioner of Buildings shall appoint according to law such Building Inspectors as may be necessary.

(b) Every person certified to fill the position of Building Inspector shall be a civil, structural, architectural or fire protection engineer, or an architect, or a building superintendent or a building mechanic with at least five years' experience in general building construction. The Building Inspectors shall, under the direction of the Building Inspector in Charge, examine all buildings and structures in the course of erection, enlargement, alteration, repair or removal, as often as is required for efficient supervision, and shall make such periodical examinations of existing structures as shall be assigned to them. They shall examine all buildings, structures and walls reported to be in dangerous condition. They shall examine all buildings and other structures for the enlarging, altering, raising or removing of which, application for permit shall be made.

(c) Every building inspector shall make written reports daily to the Commissioner of Buildings as to the condition in which he found each building examined and as to violations, if any, of the ordinances which the Commissioner of Buildings is required to enforce, together with the street and number of the premises where such violations, if any, were found, the names of the owner, agent, lessee and occupant thereof, and of the architect and the contractor engaged in and about the work in question. The Building Inspectors shall perform such other duties as may be required of them by the Commissioner of Buildings.

220. **Elevator Inspector in Charge.)** (a) There is hereby created the office of Elevator Inspector in Charge. He shall be appointed by the Commissioner of Buildings according to law.

(b) The person certified to fill the position of Elevator Inspector in Charge, shall be a graduate in engineering from a recognized technical school, shall be versed in the essentials of both mechanical and electrical engineering and shall have had at least five years experience in shop or construction work.

(c) The Elevator Inspector in Charge shall examine all plans for the installation of elevators and for the installation of mechanical devices and apparatus in theaters, amusement parks and the like, and, no such elevator, mechanical device or apparatus shall be installed or operated without the approval of the Elevator Inspector in Charge. The Elevator Inspector in Charge shall cause such inspection to be made of all new installations, as may be necessary to insure the carrying out of the approved plans and shall cause such periodic inspection to be made of existing installations of such mechanisms, devices and apparatus, as may be required by the Commissioner of Buildings, and shall perform such other duties as may be required of him by the Commissioner of Buildings.

221. **Elevator Inspectors.)** (a) The Commissioner of Buildings shall appoint according to law such Elevator Inspectors as may be necessary.

(b) Every person certified to fill the position of Elevator Inspector shall be a mechanical engineer, machinist or elevator builder, and shall be well grounded in the rudiments of mechanical and electrical engineering.

(c) The Elevator Inspectors shall inspect all elevators and such other mechanisms, devices and apparatus as shall be assigned to them by the Inspector in Charge, both existing and in process of being erected or installed, together with all the equipment and enclosures thereof. They shall make written reports daily to the Commissioner of Buildings as to the condition in which they find the elevators, equipment, enclosures, mechanisms, devices and apparatus, inspected by them, and of any violations of the requirements of this Chapter pertaining to such matters, together with the street and number of the premises where such violations, if any, occur, the names of the owner, agent, lessee and occupant thereof, and of the architect and contractor engaged in or about the construction and installation of such elevators, equipment, enclosures, mechanisms, devices or apparatus. They shall perform such other duties as may be required of them by the Commissioner of Buildings.

222. **Fire-escape Inspector in Charge.)** (a) There is hereby created the office of Fire-escape Inspector in Charge. He shall be appointed by the Commissioner of Buildings according to law.

(b) The person certified to fill the position of Fire-escape Inspector in Charge shall be a civil, structural or architectural engineer, or a man who has had not less than five years' experience in the design and erection of structural steel or in the design and construction of fire-escapes, and he shall be qualified to make all necessary computations as to the strength of any fire-escape, the design of which may be submitted for approval and to pass upon the relative merits of such various types of design as may be so submitted.

(c) The Fire-escape Inspector in Charge shall have immediate charge of the inspection of the erection of all fire-escapes and of the periodic inspection of fire-escapes, and shall pass upon the number, location, width and design of fire-escapes to be erected upon existing buildings, except where the existing building is being enlarged, altered or remodeled under a building permit issued for such enlargement, alteration or remodeling, in which case the Engineer in Charge shall pass upon the number, location, width and design of all fire-escapes required for new buildings. The Fire-escape Inspector in Charge shall also perform such other duties as may be required of him by the Commissioner of Building.

223. **Fire-escape Inspectors.)** (a) The Commissioner of Buildings shall appoint according to law such Fire-escape Inspectors as may be necessary.

(b) Every person certified to fill the position of Fire-escape Inspector shall be a person who has had at least four years' experience in superintending the erection of buildings, or in the design or erection of fire-escapes or other steel construction, or who is a graduate of a recognized technical school.

(c) The Fire-escape Inspectors shall, under the direction of the Fire-escape Inspector in Charge, inspect all fire-escapes in course of erection and shall make periodic inspection of the fire-escape equipment of existing buildings. Every such inspector shall make, daily, a written report to the Commissioner of Buildings as to the condition of the fire-escape equipment of each building or premises examined, as to the accessibility of and means of egress to such equipment, as to the presumptive adequacy of such equipment, and as to any violations of any ordinance in relation to such equipment, together with the street and number of the building or premises inspected, the names of the owner, agent, lessee and occupant thereof and of the architect and contractor, if any, engaged in operation in connection with such equipment. The Fire-escape Inspectors shall perform such other duties as may be required of them by the Commissioner of Buildings.

224. **Secretary—Duties.)** (a) There is hereby created the office of Secretary to the Commissioner of Buildings. He shall be appointed by the Commissioner of Buildings according to law.

(b) The Secretary to the Commissioner of Buildings shall, under the supervision and direction of the Commissioner of Buildings, preserve and keep all books, records and papers belonging to the office of the Department of Buildings or which are required by law to be filed therein. He shall perform such other duties as may be required of him by the Commissioner of Buildings.

225. **Clerical Assistants.)** The Commissioner of Buildings shall appoint according to law, such clerical assistants, stenographers and messengers as may be necessary; and they shall perform such duties as may be required of them by the Commissioner of Buildings.

226. **Bonds.)** The Deputy Commissioner of Buildings, the Engineer in Charge, the Assistant Engineer in Charge, the Building inspector in Charge, the Assistant Building Inspectors in Charge, the Elevator Inspector in Charge, the Fire-escape Inspector in Charge and the Architectural Engineers shall, before entering upon the duties of their offices or positions, each execute to the City of Chicago a bond, conditioned for the faithful performance of their duties, with such sureties as the City Council shall approve in the following sums: The Deputy Commissioner of Buildings, ten thousand dollars; the Engineer in Charge, the Assistant Engineer in Charge, the Building Inspector in Charge, the Assistant Building Inspectors in Charge, the Elevator Inspector in Charge, the Fire-escape Inspector in Charge, and the Architectural Engineers, five thousand dollars each.

227. **Employees Not to Engage in Another Business.)** Every employee in the Department of Buildings shall devote his entire time to such employment and shall not be engaged in any other business or vocation.

228. **Power of Entry.)** The Commissioner of Buildings and his Assistants are empowered to enter any building or structure or premises, whether completed or in process of erection, for the purpose of determining whether the same has been or is being constructed and maintained in accordance with the provisions of this chapter and it shall be unlawful to exclude them from any such building, structure or premises.

ARTICLE II.

229. **Permits—When Required—Limitations of Time For.)** Before proceeding with the erection, enlargement, alteration, repair or removal of any building or structure in the city, a permit for such erection, enlargement, alteration, repair or removal shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the erection, enlargement, alteration, repair or removal of any building or of any structural part thereof within the city unless such permit shall first have been obtained from the Commissioner of Buildings. And if after such permit shall have been granted, the operations called for by the said permit shall not be begun within six months after the date thereof, or if such operations are not completed within a reasonable time then such permit shall be void, and no operations thereunder shall be begun or completed until an extended permit shall be taken out by the owner or his agent, and a fee of ten per cent. of the original cost of permit shall be charged for such extended permit.

*230. **Permits — Application For — How Made—How Recorded—Stamped Plans—How Cared For—Return of Same.)** (a) Application for building permits shall be made by the owner or his agent to the Commissioner of Buildings. When such application is made, plans in conformity with the provisions of this chapter, which have been examined and approved by the Commissioner of Buildings and his assistants, as hereinafter provided for, shall be filed with the Commissioner of Buildings. He shall then issue a permit, and shall file such application, and shall apply to such plans a final official stamp, stating that the drawings to which the same has been applied comply with the terms of this chapter. The plans so stamped shall then be returned to such applicant. True copies of so much of such plans as may be required in the opinion of the Commissioner of Buildings to illustrate the features of construction and equipment of the building referred to, shall be filed with the Commissioner of Buildings, and shall remain on file in his office for a period of six months after the occupation of such building, after which such drawings shall be returned by the Commissioner of Buildings to the person by whom they have been deposited with him, upon demand. It shall not be obligatory upon the Commissioner of Buildings to retain such drawings in his custody for more than six months after the occupation of the building to which they relate.

(b) All plans and drawings for the construction or alteration of any building or other structure for which building permits are required shall, before such permits are issued, be presented to the Commissioner of Health for examination and approval as to the proposed plan for the ventilation of rooms, light and air shafts, windows, the ventilation of water closets, drainage and plumbing. They shall also be presented to the Fire Marshal for approval as to standpipes and all fire-fighting apparatus, where same are required. They shall also be presented to the Boiler Inspector and Smoke Inspector in all cases where permits from these departments are required to be procured by the ordinances of the city.

(c) The Commissioner of Buildings shall not issue any permit authorizing the construction, erection, repair or alteration of any building or structure unless the plans submitted for his approval clearly show that such building or structure with all its appurtenances, foundations and attachments can be erected entirely within the limits of the lot or tract of land upon which it is proposed to erect such building or structure, except as provided by the ordinances of the City of Chicago, and no permit to erect, repair or alter any building or structure shall authorize the use of any part of any public highway or other public ground for the construction or maintenance of such building or structure except as provided by the ordinances of the City of Chicago, nor shall any permit be issued for the construction or maintenance of any balcony or canopy extending over any public highway or other public ground unless permits therefor have been obtained from the proper department of the city government pursuant to an ordinance specifically authorizing the same. The plans of every building or structure which show that any part of said building or structure, or any of its appurtenances, or any attachments thereto, extend over any part of any public highway or other public ground shall first be submitted to the *Commissioner of Public Works* and notice thereby given to him of the proposed encroachment upon any public highway or other public ground. Proof of such notice to the *Commissioner of Public Works* must be presented to the Commissioner of Buildings before a permit for any such building or structure shall be issued by said Commissioner of Buildings; and no permit issued by the Commissioner of Buildings shall authorize any encroachment upon any part of any public highway or other public ground. *Amended December 12, 1910

(d) In all cases, the approved plan, together with building permits, must be kept on the job while the work is in progress.

231. **Plans—Essentials Of.)** All such plans and drawings shall be drawn to a scale of not less than one-eighth of an inch to the foot, on paper or cloth, in ink, or by some process that will not fade or obliterate. All distances and dimensions shall be accurately figured, and drawings made explicit and complete, showing the lot lines and the entire sewerage and drain pipes and the location of all plumbing fixtures within such building. Each set of plans presented shall be approved by the Commissioner of Buildings before a permit will be granted. No permit shall be granted or plans approved unless such plans are signed and sealed by a licensed architect as provided in "An Act to provide for the licensing of architects and regulating the practice of architecture as a profession in the State of Illinois," approved June 3, 1897.

232. **Plans—Alterations Upon Stamped Plans Not Permitted Without Permission—Certain Alterations Excepted.)** It shall be unlawful to erase, alter or modify any lines, figures, or coloring contained upon such drawings so stamped by the Commissioner of Buildings or filed with him for reference. If, during the progress of the execution of such work, it is desired to deviate in any manner affecting the construction or other essentials of the building from the terms of the application, or drawing, notice of such intention to alter or deviate shall be given to the Commissioner of Buildings, and his written assent shall first be obtained before such alteration or deviation may be made; but alterations in buildings which do not involve any change in their structural parts or of their stairways, elevators, fire-escapes or other means of communication or ingress or egress or in lighting or ventilation and that are not in violation of any of the provisions of this chapter, may be made without the permission of the Commissioner of Buildings.

233. **Deposit With Water Department—How Made—Indemnifying Bonds—Fees for Water Used.)** (a) Before the Commissioner of Buildings issues a permit as aforesaid he shall require evidence from the applicant that payment has been made to the Bureau of Water of the city for the water to be used or for a water meter for measuring all the water to be used in the construction of such building, under the regulations of the Bureau of Water. Such applicant shall produce evidence that he has filed with and had approved by the Commissioner of Public Works of the city an indemnifying bond protecting the city against any and all damage that may arise to the streets or alleys upon which such building abuts, and to the city and to any person in consequence, or by reason of, the proposed operations to be authorized by such permit, or by reason of any obstruction or occupation of any street or sidewalk in and about such building operations.

(b) The fees to be paid for water used in connection with the erection of buildings shall be as follows, to-wit:

At the rate of five cents for every one thousand bricks, wall measure, used in connection therewith.

At the rate of six cents for every one hundred cubic feet of rubble stone used in connection therewith.

At the rate of eight cents for every one hundred cubic feet of concrete used in connection therewith.

At the rate of fifteen cents for every one hundred yards of plastering used in connection therewith.

At the rate of five cents for every one hundred cubic feet of hollow tile arch, partition or fireproof covering used in connection therewith.

*234 **Amount of Permit Fees.)** (a) The fees to be charged for building permits shall be as follows: For sheds not exceeding three hundred square feet in area, Two Dollars; for open shelter sheds, at the rate of Fifty Cents for each one thousand cubic feet or fractional part thereof; for all buildings or other structures, other than sheds and open shelter sheds, as hereinafter described, the fee for the permit shall be at the rate of Ten Cents for every one thousand cubic feet or fractional part thereof contained therein, the cubic contents being measured to include every part of the building from the basement floor to the highest point of the roof, and to include all bay windows and other projections; but in no case, shall any permit be issued for a less fee than Two Dollars, except that a fee of One Dollar shall be charged for recovering or recoating the roof of any building.

(b) The fee to be charged for permits issued for alterations and repairs in or to any building or other structure shall be based on the cost of such alterations and repairs and shall be at the rate of Two Dollars for each Five Thousand Dollars or

part thereof to be expended therefor. The fee for permit to raise any building other than a frame building shall be Two Dollars for every twenty-five feet or fractional part thereof of frontage.

(c) In addition to the above permit fees for buildings, permit and inspection fee shall be charged as follows:
For erection of fire escapes, $2.00;
For installation or alteration of elevator, $2.00;
For semi-annual inspection of elevator, $2.00;
For erection of billboard or sign-board, $2.00 for every 25 lineal feet or fractional part thereof;
For annual inspection of billboard or signboard, 35 cents for each 25 lineal feet of billboard or signboard or fractional part thereof;
For erection of illuminated and other roof signs under Section 710 of this Chapter, $50.00 for the first 500 square feet of superficial area or fractional part thereof, and two cents for each additional square foot area.
For annual inspection of illuminated and other roof signs under Section 710 of this Chapter, $50.00;
For tearing down or wrecking a building, $2.00 for every 25 feet of frontage or fractional part thereof;
For annual inspection of building required to be inspected by Section 237 of this Chapter, $2.00 for each 25,000 square feet or fractional part thereof;
For semi-annual inspection of iron or steel curtain, $5.00;
For semi-annual inspection of asbestos curtain, $2.00;
For permit for tank or tower on roof in excess of 500-gallon capacity, $5.00;
For permit for isolated chimneys or for chimneys extending over fifty feet above the roof of any building, $5.00.

*Amended February 20, 1911.

*235. **Permit for Wrecking Building.)** (a) Before proceeding with the wrecking or tearing down of any building or other structure more than one story in height or of any structure of greater area than 2,800 square feet, a permit for such wrecking or tearing down shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the wrecking or tearing down of any building or structure or any structural part of such building or structure unless such permit shall first have been obtained. Application for such permit shall be made by such owner or his agent to the Commissioner of Buildings who shall issue such permit upon such application and the payment of the fee herein provided for. Such application shall state the location and describe the building which it is proposed to wreck or tear down. The fee for such permit shall be Two Dollars for every twenty-five feet, or fractional part thereof, of frontage. Upon the issuance of such permit, such building may be wrecked or torn down, provided that all the work done thereunder shall be subject to the supervision of the Commissioner of Buildings and to such reasonable restrictions as he may impose in regard to elements of safety and health, and provided, further, that the work shall be kept sprinkled and sufficient scaffolding be provided to insure safety to human life.

(b) Before any permit is issued granting authority to wreck a building or structure for which such permit is required, the person, firm or corporation engaged in the work of wrecking same shall file with the City Clerk a bond with sureties to be approved by the City Comptroller to indemnify, keep and save harmless the City against any loss, cost, damage, expense, judgment or liability of any kind whatsoever which the City may suffer, or which may accrue against, be charged to or be recovered from said city, or any of its officials, from or by reason or on account of accidents to persons or property during any such wrecking operations, and from or by reason or on account of anything done under or by virtue of any permit granted for any such wrecking operations. Such bond in each case shall extend to and cover all such wrecking operations carried on through permits obtained thereunder by such person, firm or corporation during any fiscal year beginning January first and ending December thirty-first, and no permit shall be issued for any wrecking work except as hereinbefore otherwise provided during such fiscal year until such bond is filed. Said bond shall be in the penal sum of twenty thousand dollars for all wrecking operations on such buildings and other structures not more than three stories in height, and there shall be an additional bond filed in the penal sum of twenty thousand dollars or a bond in the penal sum of forty thousand dollars shall be filed in the first instance in case of wrecking operations on buildings and other structures four or more stories in height. Upon the filing of such bond or bonds the person, firm or corporation engaged in the work of wrecking such buildings and other structures may obtain permits for such wrecking operations as are authorized under the said bond or bonds as hereinabove provided for during the fiscal year in which the same is or are filed: Provided, that, in case of accident or casualty in the progress of any wrecking operations carried on under any permit so issued, or the happening of any circumstance which might in the opinion of the Commissioner of Buildings render such bond or bonds inadequate, the said Commissioner may, in his discretion, require such additional bond as he may deem necessary to fully protect the city from loss resulting from the issuance of such permits before he allows the work to proceed or before any additional permits are issued by him.

*Amended January 12, 1914.

*236. **Permit—Revocation of.)** *If the work in, upon or about any building or structure shall be conducted in violation of any of the provisions of this chapter, it shall be the duty of the Commissioner of Buildings to revoke the permit for the building or wrecking operations in connection with which such violation shall have taken place. It shall be unlawful, after the revocation of such permit, to proceed with such building or wrecking operations unless such permit shall first have been re-instated or re-issued by the Commissioner of Buildings. Before a permit so revoked may be lawfully re-issued or re-instated, the entire building and building site shall first be put into condition corresponding with the requirements of this chapter, and any work or material applied to the same in violation of any of the provisions of this chapter shall be first removed from such buildings.*

*Amended February 20, 1911.

*237. **Annual Inspection of Buildings—Stairways and Means of Egress—Inspection Fee.)** (a) The Commissioner of Buildings and his assistants shall make an annual inspection of all theatres and places of amusement, worship, instruction or entertainment, and also of other buildings over two stories in height, except residences, and except tenements three stories or less in height. It shall be the duty of every owner, agent, lessee or occupant of any such building as is referred to in this section and of the person in charge or control of the same to permit the making of such annual inspection by the Commissioner of Buildings, or by a duly authorized Building Inspector, at any time upon demand being duly made.

(b) Whenever any such inspection shows the building to be in compliance with the requirements of this Chapter with respect to stairways, means of egress, and in all other respects, it shall be the duty of the Commissioner of Buildings to issue, or cause to be issued, a certificate setting forth the result of such inspection, containing the date thereof, and a statement to the effect that such building complies in all respects with the provisions of this Chapter, upon the payment of the inspection fee herein required.

(c) It shall be the joint and several duty of the owner, agent, lessee or occupant of

the building so inspected and of each and every person in charge and control of the same to frame the said certificate and place it in a conspicuous place near the main entrance of such building.

(d) It shall be the joint and several duty of the owner, agent, lessee or occupant of every building described in this section to provide a typical floor plan of such building reproduced on a sheet eight by ten inches in size. Said plan shall be drawn on as large a scale as will be practicable on such sheet, and said sheet shall also state the street address of such building, and shall give the class of the building, the kind of construction used therein, the height and the number of stories contained therein, the nature of the occupancy, and whether said building is equipped with an approved automatic sprinkler system.

(e) It shall also be the joint and several duty of such owner, agent, lessee or occupant to deliver a copy of said sheet to the Commissioner of Buildings and to frame a copy of said sheet and place the same near the framed certificate hereinabove required.

(f) It shall also be the joint and several duty of the said owner, agent, lessee or occupant to substitute a new sheet for the sheet on file with the Commissioner of Buildings, and also the sheet framed as above required, whenever such changes or alterations are made in such building as will affect the substantial accuracy of the sheet previously furnished such Commissioner and framed as above required.

(g) Where the result of such inspection shall show that such building fails in any respect to comply with the requirements of this Chapter, it shall be the duty of the Commissioner of Buildings to notify the owner, agent, lessee or occupant of such building to this effect and to specify wherein such building fails to comply with the requirements of this chapter; and it shall thereupon become the joint and several duty of such owner, agent, lessee or occupant to proceed forthwith to make whatever changes or alterations may be necessary to make such building comply in all respects with the requirements of this chapter and to complete such changes and alterations within thirty days after the receipt of such notice.

(h) Upon making such annual inspection, it shall be the duty of the owner to pay to the City Collector an annual inspection fee for the same, amounting to $2.00 for each 25,000 square feet of floor area, or fractional part thereof: *Provided however that no charge for such annual inspection shall be made against religious, charitable or educational institutions.*

Amended December 11, 1911.

238. **Architect Must Certify That Plans Comply With the Building Ordinances.)** It shall be unlawful for any architect, or other person permitted under the laws of the state to make plans, to prepare or submit to the Commissioner of Buildings for his approval any final plans for any building or structure which do not comply with the structural requirements of this chapter. It shall be the duty of the Commissioner of Buildings to require that all plans submitted to him for approval for any building or structure shall be accompanied by a certificate of such architect or such other person preparing such plans that the plans submitted comply with the structural requirements of this chapter.

*229. **Constructing Buildings Contrary to Approved Plans—Permit Made Void by Deviation from Plans—Power to Stop Work.)**

(a) It shall be unlawful for any owner, agent or architect or for any contractor or builder engaged in erecting, altering or repairing any building, to make any departure from the plans as approved by the Commissioner of Buildings of such nature that such departure involves any violation of the requirements of this chapter as to buildings of the class in which such building is, or to make any changes in plans or construction affecting means of egress, ventilation, natural lighting, or sanitary conditions without first obtaining the written consent of the Commissioner of Buildings and of the Commissioner of Health to such changes. Any such departure from the approved plans involving a violation of the requirements of this chapter or any such change in the plans or construction without the consent of the Commissioner of Buildings and of the Commissioner of Health being obtained, as required herein, shall operate to annul the permit which has been issued for such work and shall render the same void.

(b) In case any work is done under a permit authorizing the erection, alteration or repair of a building or structure, which work is contrary to the approved plans, the Commissioner of Buildings or the Commissioner of Health and their assistants shall have power to at once stop such work and to order all persons engaged therein to stop and desist therefrom. Such work shall not be resumed until satisfactory assurance has been given the Commissioner of Buildings or the Commissioner of Health that it will be done according to the approved plans or until said Commissioner of Buildings or Commissioner of Health has consented, in writing, to the changes made in such approved plans, in either of which cases a new permit must be issued before the work proceeds, for which permit the usual fee shall be paid by the contractor doing such work.

(c) No contractor or builder shall begin any work on any building or structure for which a permit is required until such permit shall have been secured. In case any work is begun on the erection, alteration, repair or removal of any building or structure without a permit authorizing the same being issued therefor, the Commissioner of Buildings and his assistants shall have power to at once stop such work and to order any and all persons engaged therein to stop and desist therefrom until the proper permit is secured.

*Amended July 22, 1912.

ARTICLE III.

Classification of Buildings.

*240. **Buildings—Class Of.)** (a) All buildings other than sheds and shelter sheds as hereafter described, now existing or hereafter erected, altered or enlarged, shall be classified as follows:

(b) **Class I.)** *In Class I shall be included every building other than department stores as described in this chapter, used for the sale, storage, or manufacture of merchandise, and every stable or garage having a ground area of 500 square feet or over.*

*Amended February 20, 1911.

(c) **Class II.)** In Class II shall be included every building referred to in subdivisions Class IIa, Class IIb and Class IIc.

(d) In Class IIa shall be included every building used for office purposes, and also every building used for club house purposes where sleeping accommodations are provided for less than twenty persons.

(e) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

(f) In Class IIc shall be included every building used for a hospital, for housing the sick and infirm, imbeciles or children, and every jail, police station, asylum, house of correction and detention, and also every home for the aged and decrepit, where sleeping accommodations are provided for more than ten persons.

(g) **Class III.)** In Class III shall be included every building used as a family residence, and also every building used for garage or stabling purposes, and having a ground area of less than 500 square feet.

(h) **Class IV.)** In Class IV shall be included every building referred to in subdivisions Class IVa, Class IVb, Class IVc, and Class IVd, as follows:

(i) In Class IVa shall be included every building used as a church or place of worship.

(j) In Class IVb shall be included every building having a parish hall, Lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

(k) In Class IVc shall be included every building hereafter erected used for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred, provided, that every building of Class IVc existing at the time of the passage of this ordinance shall comply with the provisions of Class IVb.

(l) In Class IVd shall be included every grand stand and every baseball athletic and amusement park.

(m) **Class V.)** In Class V shall be included every building which is used as a public theatre where an admission fee is charged and in which movable scenery is used, and every assembly hall hereafter erected having a seating capacity of over 300 and containing a permanent stage on which scenery and theatrical apparatus are used and regular theatrical vaudeville performances are given; provided, however, that public halls and club halls with a seating capacity of less than 600, although occasionally used for theatrical presentations, shall not be construed to be public theatres within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stages thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V as herein defined. Such public halls and club halls shall be included in Class IVb, as defined in this section.

(n) **Class VI.)** In Class VI shall be included every tenement and apartment house or building or portion thereof which is used or intended to be used as a home or residence for two or more families living in separate apartments.

(o) **Class VII.)** In Class VII shall be included every building used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as a department store.

(p) **Class VIII.)** In Class VIII shall be included every building used for school purposes having a seating capacity of more than 100 students.

(q) Requirements with regard to buildings not within any of the above classes shall be determined by the Commissioner of Buildings subject to arbitration in the same manner as provided in Sections 206 and 207 of this chapter.

241. **Buildings Used for the Purposes of More Than One Class.)** Where any building is used for the purposes of two or more classes, as herein specified, and defined, such portion of any such building as is devoted to the uses and purposes of any particular class shall be constructed, operated and maintained in accordance with the requirements of this chapter relating to such class, unless such construction shall, in the opinion of the Commissioner of Buildings, prove impracticable, or unless there would be a conflict between the provisions of this chapter relating to the construction of buildings, in either of which cases the provisions which relate to and govern the construction of buildings of the class requiring the best and safest form of construction shall govern the entire building.

242. **Conflict Between Special and General Provisions.)** Whenever any provision or requirement of this chapter relating specifically to the construction, equipment, maintenance, or operation of any building or part of a building used for the purposes of any specified class, shall conflict with the general provisions of this chapter relating to the construction, equipment, maintenance and operation of buildings generally, the special provisions shall govern in each case, except in the case of Section 514, which shall govern in all cases coming within the provisions.

ARTICLE IV.

Class I.

*243. **Class I Defined.)** *In Class I shall be included every building other than department stores, as described in this chapter, used for the sale, storage, or manufacture of merchandise, and every stable or garage having a ground area of 500 square feet or over.*

*Amended February 20, 1911.

243½. **Must Comply With General and Special Provisions.)** Every building of Class I shall comply with the general provisions of this chapter, and shall, in addition, comply with the following special provisions:

244. **Buildings—Construction of—In Relation to Height.)** (a) The construction of buildings of Class I shall be as follows: Buildings of Class I which are more than 90 feet in height shall be built of fireproof construction.

(b) Buildings of Class I which are less than 90 feet in height and more than 50 feet in height shall be built of slow-burning, mill or fireproof construction.

(c) Buildings of Class I of ordinary construction shall not be built more than four stories in height.

*245. **Skeleton Steel Walls—Metal Lath and Solid Cement Plaster Covers.)** (a) A one or two story building used for the purposes of Class I, no part of which is within twenty feet of any lot line, alley line or street line, having a complete self-supporting steel frame consisting of wall columns, supporting steel trusses, with steel trusses and steel diagonals, designed to resist safely, within the safe limits of stress provided by this chapter, a wind pressure of twenty pounds per square foot, for each and every exterior surface exposed to the wind, in addition to the dead weight of the completed structure, and in addition to the live load of 100 pounds per square foot provided for by this chapter, and any other live loads which may be imposed on such structure, may have exterior walls measuring not less than one and one-third inches thick of metal lath or metal fabric plastered on both sides with a mortar consisting only of Portland cement and torpedo sand. Complete reinforced concrete framework, built in every manner equally as strong and as safe as provided for a steel frame, in this section, may have exterior walls built in the same manner, of the same materials and of the same thickness.

(b) The enclosing walls of buildings which are built not less than fifty feet from any lot, alley or street line may be constructed of corrugated iron, supported on a steel frame built as specified in this section.

Amended February 20, 1911.

*246. **Door Openings—Revolving Doors.)** (a) The aggregate width of door openings

at the street level in buildings of Class I shall be equal to the aggregate width of stairways, as specified in Section 666 of this chapter, and all locks used on exit doors or on doors or gates leading to hallways or stairways which lead to exit doors, shall be so arranged that they may be opened from the inside without the use of a key, during business hours, or while such buildings are occupied for any purpose. In every building of this class, every door leading from a loft or space above the first story shall swing into the stair hall, and every door which is a means of exit from any floor above the first, shall swing outwardly from the space or hallway in which said stairway from such upper floor is located. No door when open shall project over a public sidewalk.

(b) Revolving doors shall not be considered as complying with this section unless the revolving wings of such revolving doors are so arranged that, by the application of a force slightly more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said doors fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than 22 inches on each side of said collapsed doors.

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the doors are collapsed, and all deficiency of required exits must be made up by additional doors.

*Amended February 20, 1911.

247. **Existing Buildings of Class I—Increasing Height of.)** In all cases where buildings of Class I of ordinary construction built prior to the passage of this ordinance, are to be increased in height above the height of fifty feet, or of mill or slow-burning construction above the height of ninety feet, the additional parts of such buildings shall be constructed as herein provided for buildings over fifty feet in height or over ninety feet in height, respectively, and said additional parts shall be made to conform in all respects to the requirements for buildings of this class more than fifty feet in height or more than ninety feet in height, respectively, before it shall be lawful to occupy them.

248. **Ceiling and Roof—Space Between.)** In buildings of Class I, if the enclosed space between a ceiling and the roof is of greater average height than two feet, access shall be provided by means of at least one stairway not less than three feet wide, leading from a public hallway or corridor.

249. **Fire Walls.)** (a) Buildings occupied by more than one person, firm or corporation, or for more than one business enterprise conducted by the same person, firm or corporation, in separate enclosures on any one floor, shall have a brick dividing wall for every fifty feet of street frontage, if of ordinary construction, or for every eighty feet of street frontage, if of slow-burning or mill construction, and such dividing walls shall extend from the front to the rear wall and such dividing walls and the doors therein shall be built in accordance with the provisions of Section 573 of this chapter.

(b) All of the partitions between the parts of such buildings occupied by different persons, firms or corporations, shall be built of incombustible material from the floor to the floor boards or roof boards next above such story or stories so occupied.

(c) Only metal framed windows glazed with one-quarter inch thick wire glass may be used in such partitions.

250. **Dividing Walls—When Required.)** (a) Dividing walls will be required in buildings of Class I as follows:

**(b) Every building of ordinary construction having a greater area than 9,000 square feet shall be divided into areas of 9,000 square feet or less by dividing walls; every building of slow-burning or mill construction more than one story in height having greater area than 12,000 square feet, shall be divided into areas of 12,000 square feet or less by dividing walls; provided, however, that buildings of slow-burning or mill construction more than one story in height and having in addition to the requirements of this ordinance relating to buildings of slow-burning and mill construction having areas not greater than 12,000 square feet, a frontage on at least two public thoroughfares, and having all stairways and elevator shafts and other floor openings enclosed with brick masonry walls with all openings in same protected with approved automatic fire doors and all stairhalls at street or ground level to open directly or through a fireproof tunnel to a street or public alley and equipped throughout on all floors and basement with an automatic sprinkler system meeting with the approval of the Chief of Fire Prevention and Public Safety may be built of an area of 16,000 square feet and if of greater area shall be divided into areas of 16,000 square feet or less by dividing walls.*

Every fireproof building more than two stories in height and having greater area than 30,000 square feet, shall be divided into areas of 30,000 square feet or less by dividing walls.

**Amended March 30, 1914.

(c) Where dividing walls are required in any of the above mentioned buildings, such building shall be subdivided by brick walls, built of the thickness given in the table for the thickness of enclosing walls and all doors or other openings in such walls shall have at each side of the same, iron doors, tin clad doors or shutters, as described in Section 573 of this chapter, and said buildings as subdivided shall be provided with stairs and fire escapes the same as hereinafter required; provided, however, that one-story buildings of ordinary mill or slow-burning construction and two-story buildings of fireproof construction of any size when used as one store, room or workshop and occupied by only one person, firm or corporation, may be erected without any dividing walls.

*251. **Display of Placard—Indicating Floor Strength.)** (a) It shall be the duty of the owner of every building of Class I now in existence or hereafter erected, or of his agent, or of the occupant, or person in possession, charge or control of same, to affix and display conspicuously on each floor of such building, a placard, stating the uniformly distributed load per square foot of floor surface, which may with safety be applied to that particular floor, as provided by this chapter, or if the strength of different parts of any floor varies, then there shall be such placards for each varying part of such floor. It shall be unlawful to load any such floors or any part thereof to a greater extent than the loads indicated upon such placards.

(b) It shall be the duty of the occupants of such buildings to maintain such placards during their occupation of the premises and of the owners of buildings, or their agents, to cause the same to be properly affixed with each change of occupation. It shall be the duty of *the owner, agent or lessee of each such building, now in existence, as well as hereafter erected, to procure and submit evidence of the correctness of the figures on such placards to the Commissioner of Buildings. Whenever such evidence as to the correctness of the figures shall be satisfactory to the Commissioner of Buildings, he shall approve such placards. Such placards so approved by the Commissioner of Buildings shall then be affixed upon the respective floors of the different buildings.* The calculations and loads shall be in accordance with the provisions of this chapter.

(c) It shall be the duty of the owner, agent or lessee to pay to the City Collector a fee amounting to five dollars ($5.00) for each fifty thousand (50,000) square feet of floor area, or fractional part thereof, for each building for which such placards are approved.

*Amended May 12, 1913.

*252. **Live Loads for Floors.)** The floors of all buildings of Class I *hereafter erected* shall be designed and constructed in such a manner as to be capable of bearing, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface, and the strength of such building shall be increased above the capacity to carry such a live load of one hundred pounds per square foot of floor surface, when the uses to which such building, or part thereof, is to be applied, involve greater stress. The calculations and loads shall be in accordance with the provisions of this chapter. *In every building of Class I now constructed and in use, whenever it shall be found by the Commissioner of Buildings that the floors of same, or any part or parts thereof, are not capable of bearing, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be upon the same, a live load of forty pounds for every square foot of surface, he shall condemn the same and order such floor or floors to be repaired or reconstructed within a reasonable time by the owner or occupant thereof, and shall proceed in the manner prescribed in sections 201 and 202 of The Chicago Code of 1911, and in such case it shall be unlawful for the owner or occupant to continue to use such building until the said floors shall be repaired or reconstructed in accordance herewith.*

*Amended November 13, 1911.

253. **Elevator Buildings.)** Elevator buildings intended solely for the receipt, storage and delivery of grain in bulk, shall be of fireproof construction as described in this chapter.

ARTICLE V.
Class II.

254. **Class II Defined.)** (a) In Class II shall be included every building referred to in subdivisions Class IIa, Class IIb and Class IIc.

(b) In Class IIa shall be included every building used for office purposes, and also every building used for clubhouse purposes where sleeping accommodations are provided for less than twenty persons.

(c) In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

(d) In Class IIc shall be included every building used for a hospital, for housing the sick and infirm, imbeciles, or children, and every jail, police station, asylum, house of correction and detention, and also every home for the aged and decrepit, where sleeping accommodations are provided for more than ten persons.

254½. **Must Comply With General and Special Provisions.)** Every building of Class II shall comply with the general provisions of this chapter, and in addition to the general provisions shall comply with the following special provisions:

255. **Allowance for Live Loads in Construction of Floors of Class II.)** For all buildings of Class II the floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of fifty pounds for every square foot of surface, and such live load shall be computed in accordance with the provisions of this chapter.

256. **Windows and Mechanical Ventilation.)** (a) In every building hereafter erected for or converted to the purposes of this class, courts shall be of the minimum widths and areas prescribed in Section 442 of this chapter, and vent shafts as defined in Section 432 of this chapter, shall be of the following minimum width and areas:

Height of Shaft.	Least Width in Feet.	Square Feet.
1 story	3	21
2 stories	3	22½
3 stories	3	27
4 stories	3	36
5 stories	5	48
6 stories	6	72
7 stories	8	96
8 or more stories	8	120

(b) In every building hereafter erected for or converted to the purposes of this class, every room used as a private sitting room or as a sleeping room, shall have at least one window which opens directly upon a street, alley, yard or court. The total glass area of such window or windows opening directly upon a street, alley, yard or court shall be not less than one-tenth of the floor area of such room. The top of at least one such window shall be at least seven feet above the floor and at least the upper half of such window shall be capable of being opened. No such window shall have a glass area of less than ten square feet unless it be a window in excess of the one-tenth of the floor area as required by this paragraph. Provided that sleeping cells in prisons, jails, police stations and houses of detention need not have each a window opening directly on a street, alley, yard or court if such cells are in a cell block which has windows with a glass area equal to one-fourth of the floor area of such block and arranged so that each window may be opened for one-half of its area, and provided further that such cell block and cells shall be equipped with a system of mechanical ventilation approved by the Commissioner of Health.

(c) In every building hereafter erected for or converted to the purposes of this class, every pantry, bath room and water closet and urinal compartment shall have at least one window which opens directly upon a street, alley, yard, court or vent shaft; the total glass area of such window or windows opening directly upon a street, alley, yard, court or vent shaft shall be not less than one-tenth of the floor area of such room or compartment. The top of at least one such window shall be at least seven feet above the floor and at least the upper half of such window shall be capable of being opened; and no such window shall have a glass area of less than six square feet or a glass width of less than one foot; provided, however, that such room or compartment, if located in the upper story of any such building, may be lighted and ventilated by means of a skylight having a glass area equal to one-tenth of the floor area of the room it serves and be equipped with an efficient ventilator or ventilators equal in effective area to one-twentieth of the floor area of such room; and provided further, that any such room or compartment in a building used for office, club or hotel purposes, in lieu of such window or windows, may be ventilated by an approved mechanical ventilation system which shall effect at least six complete changes of air per hour.

(d) In every building hereafter erected for or converted to office, hotel or club purposes, every room, except a room used as a bakery, which is below street grade and which is frequented by the public or in which there are regularly employed five or more persons, shall be ventilated by an approved mechanical ventilating system which shall effect at least six complete changes

of air per hour; provided that in case of store rooms below street grade having 1,500 cubic feet of space per person employed therein two changes of air per hour will be deemed sufficient. In buildings of this class every room, either above or below grade, used as a bakery, shall comply with the provisions of the ordinances of the City of Chicago in respect to bakeries.

(e) In every building hereafter erected for or converted to the purposes of this class, every room not otherwise specifically provided for in this section shall, where practicable, have a window or windows, with a total glass area not less than one-tenth of the floor area of such room, opening directly onto a street, alley, yard or court, and no such window shall have a width of less than one foot or a total glass area of less than ten square feet, unless such window is in excess of the ten per cent of floor area requirement; provided that, if it be impracticable to ventilate any such room by windows as aforesaid, such rooms shall be ventilated by an approved mechanical ventilating system which shall effect at least six complete changes of air per hour; the air supply being taken from the outer air at a point not less than ten feet above the street level.

(f) It shall be the duty of the owner, agent, architect, or party in possession or control of any building in which a mechanical system of ventilation shall have been installed under the requirements of this section, upon completion of such system, to notify the Commissioner of Health in writing at least twenty-four hours in advance of the making of a test of such system; and each such system or unit shall be tested for volumetric efficiency by the owner or his representative in the presence of the representative of the Commissioner of Health and such system shall not be considered as meeting the requirements of this section until it shall have been approved by the Commissioner of Health. Every such mechanical ventilating system shall at all times be kept in good repair and in operation so as to insure the required ventilation of all rooms and compartments planned to be ventilated thereby, during all hours of human occupancy.

Class IIa.

257. **Class IIa Defined.)** In Class IIa shall be included every building used for office purposes, and also every building used for club house purposes where sleeping accommodations are provided for less than twenty persons.

258. **Buildings—Construction of—Height of.)** (a) Buildings of Class IIa which are ninety feet or more in height shall be built entirely of fireproof construction.

(b) Buildings of Class IIa less than ninety feet and more than fifty feet in height shall be built either of slow-burning, mill or fireproof construction.

(c) Buildings of Class IIa not exceeding fifty feet in height may be built of ordinary construction.

Class IIb.

259 **Class IIb Defined.)** In Class IIb shall be included every building used for hotel, club, lodging or rooming house purposes where such building has sleeping accommodations for twenty or more persons.

260. **Buildings—Construction of—Height of.)** (a) Buildings of Class IIb more than five stories and basement high shall be of fireproof construction.

(b) Buildings of Class IIb more than three stories and basement high but not more than five stories and basement high shall be of slow-burning or fireproof construction. In case slow-burning construction be required the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction.

261. **Walls—Divisions and Partitions—Fire Stops.)** (a) In buildings hereafter erected used wholly, or in part for the purposes of Class IIb of ordinary, slow-burning or mill construction, there shall be for every eight rooms in any one story, dividing walls or partitions of incombustible material separating such eight rooms from the contiguous spaces.

(b) In all buildings hereafter erected to be used wholly or in part for the purposes of Class IIb, all elevators and stairs shall be enclosed in partitions of incombustible or fireproof material, and the partitions of all corridors leading to such elevators and stairs shall be of fireproof or incombustible material. Such partitions shall be carried on self-supporting masonry or a framework of steel or iron. Where glass is used in said partitions, the same shall be wired glass set in metal frames but such glass shall not exceed sixty per centum of the superficial area of said partitions.

(c) In all non-fireproof buildings of Class IIb there shall be between joists a stop of brick, concrete or tile not less than four inches in thickness, extending the full height of joists and spaced not more than twenty-five feet apart, measured in the direction of the length of the joist.

262. **Sleeping Stalls in Rooms—When Allowed.)** Sleeping stalls shall not be constructed or used in any room in any building now existing or hereafter erected and devoted, in whole or in part, to the purposes of a lodging or rooming house unless such room has two or more windows which open directly upon a street, alley, yard or court and which windows have a total area equal to at least one-tenth of the floor area of such room, nor unless the semi-partitions forming such stalls are so constructed that there is a clear and unobstructed interval of at least thirty inches between the top of such semi-partitions and the ceiling of the room, nor unless each such stall shall open directly into an aisle or passageway leading directly to a stairway or stairway fire escape, the location of which is indicated by a red sign and at night by a red light also. Such sleeping stalls shall not be installed in any such room in such numbers that there shall be less than 400 cubic feet of air per person when all stalls are occupied to their full capacity. The semi-partitions forming such stalls hereafter constructed shall be of incombustible material.

Class IIc.

263. **Class IIc Defined.)** In Class IIc shall be included every building used for a hospital, for housing the sick and infirm, imbeciles or children and also every jail, police station, asylum, house of correction and detention and also every home for the aged and decrepit, where sleeping accommodations are provided for more than ten persons.

*264. **Buildings—Construction of—Height of.)**

(a) All buildings of Class IIc more than two stories in height hereafter erected for or converted to the purposes of Class IIc shall be of fireproof construction except that buildings erected for or converted to the use of police stations for temporary purposes may be of mill or slow burning construction."

*Amended May 15, 1911.

(b) Buildings of Class IIc not more than two stories in height may be of ordinary, mill or slow-burning construction.

265. **Frontage Consents for Hospitals.)** It shall be unlawful for any person, firm or

corporation to build, construct, maintain, conduct or manage in any block in which two-thirds of the buildings fronting on both sides of the street or streets on which the proposed hospital may front are devoted to exclusive residence purposes, any hospital unless the owners of a majority of the frontage in such block and the owners of a majority of the frontage on the opposite side or sides of the street or streets on which said building faces consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in said block. Such written consents of the majority of said property owners shall be filed with the Commissioner of Health before a permit shall be granted for the building or constructing, or a license be issued for the maintaining, conducting or managing of any such hospital.

266. **Coves in Rooms and Corridors of Hospitals.)** In every building hereafter constructed for or converted to hospital purposes, in all corridors and rooms used by patients, all intersections of walls, floors and ceilings shall be formed with tangent coves.

267. **Elevators in Hospitals.)** Every building over three stories in height hereafter constructed for or converted to hospital purposes shall have at least one elevator, the floor dimensions of which shall be not less than seven feet by five feet, and said elevator shall be enclosed in a fireproof shaft with incombustible doors closing off each opening and shall comply with all the general provisions of this chapter.

268. **Fire Escapes, Balconies, Platforms.)** All buildings of Class IIc shall be equipped with stairway fire escapes not less than three feet in width which shall, in number, location and structural features, comply with the general provisions of this chapter relating to fire escapes. The balconies and platforms of such fire escapes shall be not less than three feet in width and may be made with a smooth surface of incombustible material laid flush with the floor and with a pitch of one-third inch to the foot.

269. **Standpipes and Portable Hand Pumps.)** (a) On each floor of every building used for the purposes of Class IIc there shall be provided, for each two thousand square feet of floor area or fractional part thereof, at least one portable hand pump of three gallon capacity or one chemical extinguisher of equal capacity, which shall be located and maintained subject to the approval of the Fire Marshal.

(b) In every building more than three stories in height hereafter erected for or converted to the purposes of Class IIc there shall be constructed one or more four-inch stand pipes which shall extend from the basement to the roof and which shall be connected with the house pump and house tank and which shall have a Siamese connection located on the street or alley side of such building for the use of the first department. Each stand pipe shall be provided with one hose connection with fire department thread on the roof of said building, and one connection on each floor and in the basement thereof, with sufficient hose attached on each floor and in the basement so that a stream of water therefrom will reach any point thereof. The pattern, quality, installation and maintenance of such stand pipes, hose and connections shall be subject to the approval of the Fire Marshal.

ARTICLE VI.
Class III.

270. **Class III Defined.)** (a) In Class III shall be included every building used as a family residence, and also every building used for garage or stabling purposes and having a ground area of less than 500 square feet.

270½. **Must Comply With General and Special Provisions.)** Every building of Class III shall comply with the provisions of this chapter, and, in addition to the general provisions, shall comply with the following special provisions:

*271. **Buildings—Construction of—Height of—Space Occupied on Lot.)** (a) Every building of Class III which is ninety feet or more in height shall be built entirely of fireproof construction.

(b) Every building of Class III less than ninety feet and more than fifty feet in height shall be built entirely of slow-burning, mill or fireproof construction.

(c) Every building of Class III less than fifty feet in height may be built of ordinary construction.

(d) The amount of space occupied on any lot by Class III buildings shall comply with the requirements of Section 440 of this chapter.

(e) *Buildings used for garage purposes only, having a ground area of four hundred (400) square feet or less, may be built with enclosing walls and roof of corrugated iron or galvanized sheet steel supported on a frame of steel construction.*

*Amended December 18, 1911, by adding (e).

272. **Skylights — Construction of — Glass in.)** (a) The skylight on the roof of every building of Class III erected within the fire limits shall have its sides, sashes and frames constructed of metal or of metal-clad wood on all exterior surfaces.

(b) Such skylights shall be covered by a strong wire netting with mesh not more than one and one-half inches square placed not less than six inches above the glass, supported on uprights of incombustible material, unless wired glass is used.

273. **Allowance of Live Loads in Construction of Floors.)** In every building of Class III, the floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of 40 pounds for every square foot of surface.

*274. **Habitable Rooms—Definition of—Requirements as to Size and Ventilation.)** (a) For the purposes of this chapter the term "habitable room" shall be held to include every room in every building of Classes III and VI, and every room in buildings of other classes if such rooms are used for the purposes of Classes III and VI, in which a family or the individual members thereof regularly sleep or eat or carry on their usual domestic or social vocations or avocations. Laundries, bath rooms, water closet compartments, serving and storage pantries, storage rooms and closets, boiler and machinery rooms, cellars, corridors, and similar spaces used neither frequently nor during extended periods, shall not be deemed as coming within the scope of this term.

(b) In every building hereafter erected for or converted to the purposes of Class III, every habitable room shall have a window or windows with a total glass area equal to at least one-tenth of its floor area, opening onto a street, alley, or yard, as defined in Section 432 of this chapter; provided, that there shall be a space of at least three feet between the building and the lot line on one side, and a space of at least one foot between the building and the lot line on the other side. None of such required windows shall have a glass area of less than ten square feet; and each such window shall have its top not less than seven feet above the floor and shall be so constructed that at least its upper half may be

opened its full width. No such habitable room shall have a floor area of less than eighty square feet, nor a clear height from floor to ceiling of less than eight feet and six inches; provided that attic rooms need not be eight feet six inches high for more than one-half of their area, and that such attic rooms shall have total cubic contents of not less than seven hundred and fifty cubic feet each.

*Amended February 20, 1911.

(c) No living room shall be partitioned off or constructed in any existing building or portion thereof, until plans of such building and room have been filed with, and a permit for such partitioning or constructing obtained from the Commissioner of Buildings and the Commissioner of Health; and every room so partitioned off or constructed shall comply with all the requirements for habitable rooms as contained in this section.

275. **Alcoves.)** Every alcove and alcove room shall comply with the requirements of Section 446 of this chapter.

276. **Pantries, Bath Rooms, Water Closet and Urinal Compartments—Requirements in Relation Thereto.)** In every building hereafter erected for or converted to the purposes of Class III, every pantry, bath room, water closet or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of at least one foot opening upon a street, alley, or yard as defined in Section 432 of this chapter, or upon a vent shaft not less in area than said window; and no habitable room shall open into or connect with a vent shaft thus used.

277. **Bay Windows and Light Shafts—Materials For.)** Bay or oriel windows may be built of combustible material on front or rear elevations of buildings of Class III of two stories or less in height, within the fire limits, provided such bay and oriel windows shall not have a greater width than twelve feet at the wall line of the building, and, provided, that the outside walls, roofs and soffits of such bay or oriel windows, when so constructed, shall be covered with sheet metal or other incombustible material. Light shafts wholly within the walls of a two-story building of Class III may be built of combustible material covered with sheet metal or other incombustible material. In all other cases, bay and oriel windows and light shafts and their supports shall be constructed entirely of incombustible material.

278. **Walls—Brick Walls Upon Wooden Sills—Level of Sills Allowed.)** Every building of Class III not exceeding one story or twenty feet in height from top of sills to the highest point of the roof, and with the side walls not exceeding fourteen feet in height, and with floor area not exceeding twelve hundred square feet, may have brick walls not less than eight inches in thickness erected upon wooden sills, the sills supported on iron, masonry, or concrete supports extending four feet below the surface of the ground, provided that the portion of the supports above the ground may consist of cypress or cedar posts. The foundations under such supports shall be of concrete, stone or brick, each covering not less than five square feet area and not more than eight feet apart, to support with safety the weight that may rest upon them; sills shall be placed not higher than four feet above the established grade of the street upon which the lot fronts and upon which lot the building is erected, where grades are established, and not exceeding seven feet above the ground where grades are not established. Every building more than one story and less than two stories high, having a gable or hip roof with a rise of not more than thirty degrees, may have eight-inch walls of solid brick or stone masonry, provided the side walls do not exceed fourteen feet in height measured from the first floor joist, and provided such building has a floor area not exceeding 1,200 feet and is not over 22 feet in width.

279. **Stairways in Buildings of Class III Hereafter Erected Three Stories or More in Height.)** In every building of Class III hereafter erected, and three stories or more in height, there shall be either two stairways from the first to the top story or one such stairway and a fire escape.

ARTICLE VII.

Class IV.

(NOTE: *See end of ordinance, page 161 for special ordinance on regulations for operating places of amusement.*)

280. **Class IV Defined.)** (a) In Class IV shall be included every building referred to in subdivisions Class IVa, Class IVb, Class IVc and Class IVd, as follows:

(b) In Class IVa shall be included every building used as a church or place of worship.

(c) In Class IVb shall be included every building having a parish hall, lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction, other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

(d) Class IVc shall include every building hereafter erected used for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred; provided, that every building of Class IVc existing at the time of the passage of this ordinance shall comply with the provisions of Class IVb.

(e) In Class IVd shall be included every grandstand and every baseball, athletic and amusement park.

281. **Must Comply with General and Special Provisions.)** Every building or structure of Class IV shall comply with the general provisions of this chapter and shall, in addition, comply with the following special provisions:

282. **Must Comply With All Ordinances.)** It shall be unlawful for any person, firm or corporation to construct or alter any theatre except in conformity with the ordinances of the City of Chicago relative thereto, or to operate any theatre that does not conform thereto.

283. **City Officials Empowered to Enter.)** The Commissioner of Buildings, Commissioner of Health, City Electrician, Fire Marshal, Superintendent of Police, and their respective assistants, shall have the right to enter any building used in whole or in part for the purposes of Class IV at any reasonable time, and at any time when occupied by the public, in order to examine such building, and it shall be unlawful for any person to interfere with them in the performance of their duties.

284. **City Officials Empowered to Close.)** The Commissioner of Buildings, Commissioner of Health, Fire Marshal, City Electrician, or Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Class IV, to be closed, where it is discovered that there is any violation

of any of the provisions of this chapter, and kept closed until the same are complied with.

285. **Theaters in Frame Buildings Prohibited.)** On and after June 1, 1911, no frame building or part thereof shall be used as a moving picture, vaudeville or other theatre.

286. **Buildings—Height—Construction—When Used in Part as Class IV.)** Every building higher than sixty feet, used in whole or in part for the purposes of Class IV or connected with or made part of any building so used, shall be entirely of fireproof construction. Every such building less than sixty feet in height shall be made of fireproof, slow-burning or mill construction, except as provided in this chapter.

CLASS IVa

287. **Class IVa Defined.)** In Class IVa shall be included every building used as a church or place of worship.

288. **Frontage—Seating Less than Eight Hundred.)** Every building of Class IVa hereafter erected containing an aggregate capacity of 800 persons or less, shall have for the auditorium a frontage upon two open spaces, of which at least one shall be a street, and the other, if not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street or alley.

289. **Frontage—Seating Over Eight Hundred.)** Every building of Class IVa hereafter erected containing an aggregate seating capacity greater than eight hundred persons, shall have for the auditorium a frontage upon three open spaces of which at least one shall be a public street and the others, if not streets, shall be public or private alleys of a width of not less than ten feet each, opening directly on a public street or alley.

290. **Construction of.)** (a) Every building of Class IVa, which has a seating capacity of less than 600 may be built of ordinary construction. Every building Class IVa having a seating capacity of more than 600 and less than 1,800 shall be built of slow-burning, mill or fireproof construction.

(b) Every building of Class IVa having an aggregate seating capacity greater than 1,800 persons shall be built of fireproof construction.

291. **Limitations of Floor Level in Class IVa—Height Above Sidewalk.)** (a) The limitations of floor levels in buildings hereafter erected, occupied either wholly or in part for the purposes of Class IVa, shall be as follows:

(b) No auditorium of a greater seating capacity than 1,000, shall have the highest part of its main floor at a greater distance than 10 feet above the adjacent sidewalk grade. No room or rooms having a greater seating capacity than five hundred shall be at a greater distance above the sidewalk grade than twenty feet. No room or rooms used for the purposes of Class IVa having a greater seating capacity than two hundred shall be at a higher level above the sidewalk grade than thirty feet; provided, however, that in the case of a building used either wholly or in part for the purposes of Class IVa, and built of fireproof construction, a room or rooms to be used for the purposes of Class IVa and of an aggregate seating capacity of less than five hundred may be located in any story thereof, but in such case, there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located, to the ground, each of which stairs shall be not less than 4 feet wide in the clear and shall be equipped with emergency exits and not less than one stairway fire escape.

292. **Allowance for Live Loads in Construction of Floors of Buildings of Class IVa—Stairways—Entrances and Exits, Width of.)** Every floor in buildings of Class IVa shall be designed and constructed in such a manner as to be capable of bearing in all its parts, in addition to the weight of floor construction, partitions, and permanent fixtures that may be set upon same, a live load of 100 pounds for every square foot of surface on such floor. The width of stairways in buildings of this class shall be twenty inches for every one hundred of the aggregate seating capacity, and for fractional parts of one hundred seating capacity, a proportionate part of twenty inches shall be added to the width of such stairway, but no stairway in such building shall be less than four feet wide in the clear, except as hereinafter provided, and provided further, that in any such building having a gallery, the seating capacity of which does not exceed two hundred and fifty persons, two separate and distinct stairways, each not less than three feet wide, shall be permitted.

293. **Galleries—Exit and Entrance.)** Distinct and separate exits shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the gallery or galleries, provided its capacity be equal to the aggregate capacity of all aisles or corridors leading from the main floor and such gallery or galleries to such place of exit or entrance. Not more than two galleries, placed one above the other, shall be permitted in any building of (Class IVa).

*294. **Stairways—Aisles—Steps in Aisles—Passageways, Kept Unobstructed.)** (a) Aisles in buildings of Class IVa shall, in the aggregate, be eighteen inches in width for each 100 of the seating capacity of the auditorium, and for fractional parts of 100, a proportionate part of 18 inches shall be added, but no aisle shall be less than two feet six inches in width in its narrowest part. Steps shall be permitted in aisles only as extended from bank to bank, of seats, and wherever the rise from bank to bank of seats is less than five inches, the floor of the aisles shall be made on an inclined plane; and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors. All aisles and passageways shall be kept free from all portable furniture and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles or passageways during the services.

(b) *Amended February 20, 1911, by striking out said paragraph.

295. **Corridors, Passageways, Hallways and Doors—Width of.)** The width of corridors, passageways, hallways and doors, adjacent to, connected with, or a part of the auditorium, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be less than four feet in width, and no such doorway shall be less than three feet in width.

296. **Seats, Number of, in Rows.)** There shall not be more than fourteen seats in any one row between aisles. Rows of seats shall not be less than two feet eight inches from back to back, and no bank of seats shall be of greater rise than twenty inches.

297. **Emergency Exits—All Doors to Open Outward.)** (a) Emergency exits and outside stairways shall be provided for every building of Class IVa, which has a

larger seating capacity than 800. Such emergency exits shall be one-half the aggregate width of the main exits, but no such emergency exits shall be less than three feet in width. Provided, that such stairways may be built inside the walls of the building in a corridor or passageway not less than seven feet wide and enclosed by a fireproof partition not less than four inches thick. Such stairway shall be of fireproof construction. All emergency exits and stairways therefrom shall be kept free from obstructions of any kind including snow and ice.

(b) All doors affording egress, directly or indirectly from the auditorium to a street or alley, shall open outward. Exit doors shall not be obscured by draperies and shall not be locked or fastened in any manner during the time that the building is occupied, and shall be so constructed and maintained that they may be easily opened from within.

298. **Buildings in Which Seats are Not Fixed—Seating Capacity.)** In computing the seating capacity of any room or building used for the purposes of this class in which the seats are not fixed, an allowance of six square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation. Provided, that in buildings of Class IVa standing at least seven feet from any other building and not having more than two stories and each floor having its own separate exits, the seating capacity of such floor shall be estimated alone as determining the kind of construction under this article.

299. **Every Portion to Be Lighted When Occupied at Night—Flues.)** Every portion of a building of Class IVa and all outlets therefrom leading to streets or spaces connected therewith, including the vestibules, halls, corridors, passageways, and stairway exits, shall be properly lighted whenever occupied between sunset and sunrise, and the same shall be kept so lighted until the entire audience have left the premises; and every passageway, corridor, stairway and exit shall be provided with a sign indicating the way out of the building, the letters of which shall not be less than six inches in height. All lights indicating exits in vestibules, halls, passageways, corridors or other means of egress from the building shall be controlled by a separate shut-off, located near the main entrance, and controlled only in that particular place. A red light furnished by gas or sperm oil shall be kept burning, in connection with the word "Exit" over every such opening, during the entire time such building is occupied between sunset and sunrise. Flues used to carry off heat from open lights shall be of incombustible material, and shall have at least twelve inches clearance from any combustible material.

Class IVb.

300. **Class IVb Defined.)** In Class IVb shall be included every building having a parish hall, lodge hall, dance hall, banquet hall, skating rink, assembly hall, halls used for the purpose of exposition and exhibition, and buildings having a hall for the purpose of instruction, other than schools, included in Class VIII, and also every existing building having a hall used for theatrical purposes at the time of the passage of this ordinance, except such buildings as are included in Classes IVa, IVc, IVd, and V.

301. **Frontage—Seating Less Than Eight Hundred—Seating More Than Eight Hundred.)** (a) Every building of Class IVb, containing a hall or halls of an aggregate seating capacity of 800 persons or less, shall have a frontage upon two public spaces, of which at least one shall be a street, and the other, if not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street or alley.

(b) Buildings of Class IVb, containing halls or rooms, used for the purpose of Class IVb, of greater aggregate seating capacity than 800, shall have a frontage upon three open spaces, of which at least one shall be a public street, while the other two, if not streets, shall be public or private alleys, of a width of not less than ten feet, each opening directly on a public street or alley; provided that a fireproof passageway at grade level, and not less than seven feet in width may be used in place of one such alley, if such passageway connects with a public thoroughfare.

302. **Auxiliary Buildings—Height and Construction of—Communicating Doors.)** (a) Every building hereafter erected and connected with or made part of any building used in whole or in part for the purposes of Class IVb, shall, if sixty or less feet in height, be of fireproof, mill or slow-burning construction, except as otherwise provided in this chapter, and, if more than sixty feet in height, of fireproof construction.

(b) No existing building, other than of fireproof construction, shall be connected to any building of Class IVb now existing or hereafter constructed, unless there is, between such buildings, a fire wall constructed as required by Section 519 of this chapter and extending from the ground to and through the roof.

(c) In all such cases where both buildings are not of fireproof construction, each opening in the intervening walls shall be equipped with automatic double fire-doors as required by Section 573 of this chapter.

303. **Existing Buildings—Used for Class IVb and for Other Purposes.)** No part of an existing building, other than of fireproof construction shall be used for the purposes of Class IVb unless such part is separated from all portions of the same building used for other purposes by a fire wall constructed as required by Section 519 of this chapter and extending from the ground to the roof and unless all openings in such fire wall are equipped with automatic double fire doors as required by Section 573 of this chapter; in which case such other portions may be constructed in the manner permitted for separate buildings of such class.

304. **Construction—Depending on Capacity.)** Every building used for the purposes of Class IVb, hereafter erected, containing a hall or room of an aggregate seating capacity of not more than 1,500 persons, shall be built of mill, slow-burning or fireproof construction. Every building hereafter erected used for theatrical purposes, with a seating capacity greater than three hundred shall be built to conform to the requirements of buildings of Class V hereafter erected. If a hall or room or halls or rooms have a total seating capacity of more than 1,500 persons, such building shall be built of fireproof construction; provided, that buildings mainly used for exposition or exhibition purposes, and not used for theatrical purposes, and not exceeding two stories in height which have for public use only a main floor and one gallery and which have their walls and structural members of incombustible material and which comply with the provisions of this ordinance as to stairways, exits and fire escapes, may have their temporary seats, boxes, show cases, platforms, or booths, constructed of combustible material; provided, however, that any and all draperies, buntings, or other

inflammable decorations shall be treated with a fire-retarding solution, subject to the approval of the Fire Marshal.

305. **Buildings in Which Seats Are Not Fixed—Seating Capacity.)** In computing the seating capacity of any room or building used for the purposes of this Class, in which the seats are not fixed, an allowance of six square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation. Provided, that in buildings of Class IVb standing at least seven feet from any other building and not having more than two stories and each floor having its own separate exits, the seating capacity of each floor shall be estimated alone as determining the kind of construction under this article.

*306. **Limitations of Floor Levels—Height Above Sidewalks.)** (a) The following limitations of floor levels in buildings hereafter erected, occupied either wholly or in part for the purposes of Class IVb, *other than skating rinks,* shall be as follows: No auditorium of a greater seating capacity than one thousand shall have the highest part of its main floor at a greater distance than ten feet above the adjacent sidewalk grade. No room or rooms having a greater seating capacity than five hundred shall be at a greater distance above the sidewalk grade than twenty feet. No room or rooms used for the purposes of Class IVb having a greater seating capacity than two hundred shall be at a higher level above the sidewalk grade than thirty feet; provided, however, that in the case of a building used either wholly or in part for the purposes of Class IVb, and built of fireproof construction, a room or rooms to be used for the purposes of Class IVb and of an aggregate seating capacity of less than five hundred may be located in any story thereof, but in such case, there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located, to the ground, each of which stairs shall be not less than four feet wide in the clear and such floor or floors shall be equipped with emergency exits and have not less than one stairway fire escape.

(b) In buildings of fireproof construction hereafter erected, banquet halls or ball rooms having a seating capacity of not more than 900 may be located on any floor. Such banquet halls or ball rooms shall have access to at least two interior stairways and not less than one stairway fire escape, the combined width of which shall be equal to at least 18 inches for each one hundred persons for whom accommodations are provided in said banquet hall or ball room.

(c) No room or hall used for the purpose of a skating rink shall be constructed, operated or maintained *with its main floor level more than two feet above the inside sidewalk grade of the street upon which the building containing same fronts or more than one foot above the ground or sidewalk level in front of such building when it does not face on a street.*

*Amended July 22, 1912.

307. **Allowance for Loads in Construction of Floors.)** All floors of all buildings of Class IVb shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floor, in accordance with the general provisions of this chapter.

*308. **Stairways—Entrances and Exits—Width of.)** The width of stairways in buildings used wholly or in part for the purposes of Class IVb, shall be 18 inches for every 100 persons of the aggregate seating capacity of all rooms used for the purposes of Class IVb in such buildings; but no stairway in such building shall be less than four feet wide in the clear; provided, that in any such building having a room or rooms, balcony or gallery, used for the purposes of Class IVb, the aggregate seating capacity of which does not exceed 250 persons, two separate and distinct stairways, each three feet wide, shall be permitted, but no such building hereafter erected shall have less than two interior stairways of the width required by this ordinance, and located as far apart as practicable. Every hall or room used for the purposes of Class IVb in a building hereafter erected, shall have access to not less than two stairways. Every stairway shall have handrails on each side thereof; stairways which are over seven feet wide shall have double intermediate handrails with end newel posts at least five and a half feet high; no stairway shall ascend a greater height than 13 feet 6 inches without a level landing, which landing shall be not less than four feet wide measured in the direction of the run of the stairs. Every stairway leading to a box or boxes shall be independent of all other stairs or seats; and such stairway shall not be less than 2 feet 6 inches wide in the clear when such box or boxes seat not to exceed thirty people, and an additional width of one inch shall be added to such stairway for each additional five persons for whom seating capacity is provided.

*Amended July 22, 1912.

309. **Balconies and Galleries—Designation of.)** Where there are balconies or galleries, the first balcony or gallery shall be designated "balcony" and the second and third balconies or galleries shall be designated respectively "gallery" and "second gallery."

310. **Balconies and Galleries—Exit and Entrance.)** Distinct and separate places of exit and entrance shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the balcony, provided its capacity be equal to the aggregate required capacity of all aisles or corridors leading from the main floor and such balcony to such place of exit and entrance.

311. **Aisles—Steps in Aisles—Passageways—Kept Unobstructed—Width of Corridors, Passageways, Hallways and Doors.)** (a) Aisles in rooms used for the purposes of Class IVb shall have in the aggregate a width of 18 inches for each 100 of the seating capacity of such room, and for fractional parts of 100 a proportionate part of 18 inches shall be added; but no aisle shall be less than two feet six inches in width.

(b) Steps shall be permitted in aisles only as extending from bank to bank of seats, and whenever the rise from bank to bank of seats is less than five inches the floor of the aisles shall be made as an inclined plane, and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together, and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors. All aisles and passageways in such rooms shall be kept free from campstools, sofas, chairs and other obstructions, and no persons shall be allowed to stand in or occupy any of such aisles or passageways during any performance, service, exhibition, lecture, concert, ball, or any public assembly.

(c) Where there are emergency exits located at the sides of such rooms, there shall be a cross aisle giving access to such exits. The location of emergency exits and cross aisles shall be subject to the approval of the Commissioner of Buildings.

312. **Corridors, Passageways, Hallways and Doors—Width of.)** The width of cor-

ridors, passageways, hallways and doors adjacent to, connected with or a part of such rooms, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be less than four feet in width, and no such door shall be less than three feet in width.

313. **Seats—Number in Rows.)** There shall be not more than fourteen seats in any one row between aisles, and in a room or rooms used for the purposes of Class IVb, of a seating capacity greater than 400 persons, there shall be an aisle on each side of any bank of seats, where there are over seven seats in a row. Rows of seats shall not be less than thirty-two inches from back to back and no bank of seats shall be of a greater rise than twenty inches.

314. **Emergency Exits.)** (a) Emergency exits and stairways shall be provided outside of any and all rooms used for the purposes of Class IVb which have a seating capacity larger than eight hundred, and such emergency exits shall have a width equal to one-half of the width provided for the main exits and such emergency exits shall lead directly to a public thoroughfare. Provided, however, that any room or rooms used for the purposes of Class IVb in any building hereafter erected, having a seating capacity of more than 400, shall have emergency exits outside of the walls of such building equal in width to one-half of the exits required for the main exits, and such emergency exits shall lead directly to a public thoroughfare. Doors leading to emergency exits shall not be less than three feet wide. Stairs shall be not less than four feet wide. Such emergency exits and stairways may be built inside the walls of such building of a width not less than four feet, provided that they are enclosed by a fireproof partition not less than 4 inches thick; and further provided, that the stairs themselves are constructed of incombustible material. Emergency stairways may descend into open spaces or passageways, provided they do not obstruct more than one-half of the width of such open spaces or passageways.

(b) Every stairway fire escape shall be located and constructed in accordance with the requirements of Sections 669, 670 and 673, but in no case shall any room used for the purposes of Class IVb located above the third story of any building have less than one stairway fire escape.

315. **Doors to Open Outward—Draperies.)** (a) All doors affording access directly or indirectly to the street, alley or corridor from any room used for the purposes of Class IVb shall open outward.

(b) It shall be unlawful for any person, firm or corporation to obscure the exit doors of any room of a building of Class IVb as defined in this chapter, by draperies, and during the time any such room or rooms are open to the public, said doors shall not be locked or fastened in any manner so as to prevent them from being easily opened outwardly; and such doors shall be constructed and maintained so as to require no special knowledge or effort to open them from the interior.

316. **Walls Between Auditorium and Stage.)** There shall be a solid brick wall of the same thickness as required for outside walls between the auditorium and stage in buildings hereafter erected for or converted to the use of Class IVb and used either wholly or in part for that purpose; and in existing non-fireproof buildings such wall must extend to a height of three (3) feet above the roof. Provided, however, that in existing buildings any room used for the purposes of Class IVb at the date of the passage of this ordinance having a greater seating capacity than four hundred (400) shall have a proscenium wall built of masonry or incombustible material.

317. **Curtain Shall Be of Iron, Steel or Asbestos—Inspection of—Fee.)** The main curtain opening in any such room shall have a wrought iron or steel or three-ply asbestos curtain with a wire mesh imbedded therein, which shall be inspected by the Building Department semi-annually, for which inspection a charge of five dollars shall be made, and all other openings in the proscenium wall shall have self-closing iron doors.

318. **Structures Over Ceiling—Construction.)** If any structure intended to be occupied by people is built over the ceiling of any room, used wholly or in part for the purposes of Class IVb, the girders or trusses supporting the same shall be of steel protected with fireproofing as required for interior columns in Section 625.

319. **Standpipe and Hose on Stage.)** In every room used for the purpose of Class IVb and having a seating capacity of 250 or more, and where scenery is used a standpipe not less than one and one-half inches in diameter, with a hose connection and hose valve thereon, shall be installed on each side of the stage, and shall at all times have connected thereto and ready for use, a hose of sufficient length to reach any part of the stage. Such standpipes shall be connected with pump or frostproof gravity tank so that a pressure of water of ten pounds per square inch shall be furnished through such standpipe at the highest opening.

320. **Vents or Flue Pipes.)** (a) One or more vents of flue pipes of metal construction or other incombustible material approved by the Commissioner of Buildings shall be built over the stage, and shall extend not less than ten feet above the highest point of the roof, and shall be equivalent in area to one-twentieth of the area of the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls, and shall be continued and run up on the exterior of the building to a point five feet above the highest point of the additional stories.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches, or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Marshal, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

321. **Fuse Boxes.)** Every fuse box shall be surrounded by two thicknesses of fireproof material with an air space between, and no fuse shall be exposed to the air between the switchboards; all electrical equipment in such rooms shall be installed and maintained to the satisfaction and approval of the City Electrician.

322. **Capacity—Certification for License.)** (a) The Commissioner of Buildings shall determine the number of persons which

every room used for the purposes of Class IVb may accommodate, according to the provisions of this Chapter, and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

(b) No amusement license shall be issued for any room used for the purposes of Class IVb, unless the Commissioner of buildings, the Fire Marshal and the City Electrician shall first have certified, in writing, that such room complies with the provisions of this Chapter in every respect.

323. **Exits—Signs at—Lighting Of.)** (a) The word "Exit" shall appear in letters at least six inches high over the openings to every means of egress from every room used for the purposes of Class IVb, and in every such room having a greater seating capacity than 400, a red light furnished by gas or sperm oil shall be provided over such sign.

(b) Every room used for the purposes of Class IVb and all outlets therefrom leading to the streets, including passageways, courts, corridors, stairways, exits, and emergency stairways, shall have gas or electric lighting equipment to properly illuminate such rooms and spaces, and every passageway, court, corridor, stairway, exit, and emergency stairway, shall be provided with signs indicating the way out of the building, the letters of which shall not be less than six inches in height.

324. **Lights in Halls, Corridors and Lobbies—Control Of—Separate Shutoff—Connection with Gas Mains—Protection of Suspended and Bracket Lights—Protection of Lights Inserted in Walls—Protection of Foot Lights—Construction of Border Lights—Ducts and Shafts Conducting Heated Air From Lights—Protection of Stage Lights.)** Gas and electric lights in the halls, passageways, corridors, lobbies and other means of ingress to or egress from any such room shall be controlled by a separate shutoff, located in an accessible place, subject to the approval of the Commissioner of Buildings, and controlled only by that particular place. No gas or electric light fixture shall be inserted in the walls, woodwork, ceilings or in any part of any such room, unless protected by fireproof materials. The footlights, if gas light, shall be protected by wire network, and also by a strong wire guard, not less than two feet distant from such footlights and a trough containing such footlights shall be formed of and be surrounded by fireproof materials. Border lights shall be constructed according to the best known methods, subject to the approval of the City Electrician, and shall be suspended by wire rope. Ducts and shafts used for collecting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal, and made double with an intervening air space. Stage lights, if gas, shall have strong wire guards or metal screens, not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of flame, and such guards or screens shall be firmly soldered to the fixtures in all cases.

325. **Scenery—Definition—Movable Scenery.)** (a) "Scenery" as used in this chapter shall include all scenery, drop curtains and wings which are constructed or made of cloth, canvas or combustible material, whether stationary or movable.

"Movable scenery" shall include all scenery, drop curtains, borders and wings which are made movable for the purpose of changing scenery and substituting another set during or between the various stage acts.

326. **Scenery to Be Non-Inflammable.)** No scenery or stage paraphernalia of any sort shall be used upon the stage of any room used for the purposes of Class IVb, unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

*327. **Amount of Scenery Allowed—Sprinkler System.)** Two sets of house scenery and three drops, exclusive of asbestos fire curtain and picture screen shall be allowed in existing *rooms used for theatrical purposes in buildings of Class IVb where the same are on the first floor level, or in a building of fireproof construction or which conformed with the requirements of fireproof buildings at the time same was erected, and the same shall also be allowed in such existing rooms used for theatrical purposes above the first floor level when the seating capacity of such room does not exceed 300. Such scenery shall be known and designated upon the licenses issued by the city as "Permanent House Scenery," and the use and moving of such scenery shall not be construed as placing said building, hall, room or theatre within the provisions of the ordinance relating to Class V buildings.*

A set of house scenery as contemplated by this section is hereby defined to mean sufficient scenery to make one stage setting, such scenery being in continuous use in such house; provided, however, that the lowering of a drop shall not constitute a new stage setting.

No other scenery except as above enumerated shall be permitted on, above or underneath the stage.

Every existing Class *IVb* theatre affected by this section shall be equipped with *an approved sprinkler system and also with standpipe and hose subject to the approval of the Fire Marshal.*

No existing Class *IVb* theatre affected by this section shall increase its seating capacity after the passage of this ordinance.

No scenery or stage paraphernalia of combustible materials shall be used on the stage of any room or theatre used for the purposes of Class *IVb*, unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

*Amended July 22, 1912.

328. **Dressing Room Partitions.)** Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated.

329. **Apparatus Under Control of Fire Marshal.)** The standpipes, hose, vent flues and all apparatus for the extinguishing of fire or guarding against the same, required by the provisions of this ordinance to be provided shall be at all times so provided and kept in a manner satisfactory to the Fire Marshal.

CLASS IVc.

*330. **Class IVc Defined—Moving Picture and Vaudeville Shows—Seating Capacity.)** Class IVc shall include every building hereafter erected used for moving picture or vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, and where the seating capacity does not exceed three hundred, provided that every building of Class IVc existing at the time the passage of the ordinance *known as The Chicago Code of* 1911 shall comply with the provisions of Class IVb. *All buildings hereafter erected for moving picture and vaudeville shows and similar entertainments, where an admission fee is charged and regular performances are given, with a seating capacity of over three hundred, and for the exhibition of moving pictures only, where the seating capacity is more than one thousand, shall be built to conform with the requirements for buildings of Class*

V hereafter erected as contained in this chapter. Buildings for the exhibition of moving pictures only and with a seating capacity of over three hundred, but not to exceed one thousand, shall also be built to conform with the requirements for buildings of Class V hereafter erected, in all their structural requirements and equipment except in so far as such requirements and equipment are modified in Sections 331 and 332 hereof.

*Amended June 21, 1912.

*331. **Frontage of Class IVc—Frontage, Open Spaces and Fireproof Passageways of Moving Picture Theatres Containing a Seating Capacity of more Than Three Hundred.)** Every room used for the purposes of Class IVc shall have a frontage upon at least two public thoroughfares, of which at least one shall be a street, and the other a street or a public or private alley not less than ten feet wide and opening directly on a public street or alley.

Buildings for the exhibition of moving pictures only, with a seating capacity of over three hundred but not to exceed one thousand, shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street and the other may be a public alley not less than ten feet in width. Except as hereinafter otherwise provided, the audience room of such building shall have either a public thoroughfare or an open space unobstructed from the ground to the sky on each side thereof. Such open space, when the audience room has a capacity not to exceed six hundred seats, shall be five feet wide, and six inches shall be added to the width of same for every additional one hundred seats in said audience room up to the maximum of one thousand seats. In all cases where there is a public alley in the rear of such building, said open space must connect directly with the alley. In case the entire audience is seated on the ground level said open spaces shall extend alongside of the audience room so as to connect with exit doors placed approximately in the middle of the audience room between the opposite ends of same. Where there is a balcony or gallery installed, such open spaces must extend along the entire length of the audience room so as to connect with exits from the balcony or gallery at their highest and lowest levels. Where such a building is located on a corner lot and adjoins a public street on one side and a public street or an alley not less than ten feet wide on two of the remaining sides and the building is so located that it adjoins such public thoroughfares on three sides for its entire extent, it shall not be necessary to construct an open space on the remaining side thereof, but in all such cases there shall be either an open space unobstructed from the ground to the sky or a fireproof passageway at least five feet wide leading from the side of the audience room not bordering on a street or other public space to the street in front of the theatre and another leading to the alley or other public space in the rear of the theatre. If the seating capacity of such theatre is over six hundred, six inches shall be added to the width of such open space or passageway for every one hundred seats or fraction thereof in excess of six hundred and up to the maximum of one thousand. If access to the street and alley or other public space as herein provided is by means of a fireproof passageway, such fireproof passageway must be constructed in all respects according to the provisions of Section 402 of The Chicago Code of 1911, except as herein otherwise provided.

*Amended June 21, 1912.

*332. **Construction.)** Buildings of Class IVc hereafter erected, *of a seating capacity not to exceed three hundred shall not be built more than thirty feet in height and* may be built of ordinary construction, but the enclosing walls shall be constructed of masonry. No moving picture, vaudeville or theatrical show shall hereafter be installed in a frame building. No room or hall used for the purposes of Class IVc shall hereafter be installed underneath any living or sleeping room.

Buildings for the exhibition of moving pictures only with a seating capacity of more than three hundred but not to exceed one thousand, when the same shall be located as provided for in Section 331 hereof, may be built as herein provided. Said buildings shall contain no stage, proscenium wall nor scenery of any description. The screen for the display of the pictures must be attached to the rear wall of the building, not to exceed six inches away from same. No decorative walls or paintings or other effects shall be constructed inside the audience room in such a manner as to allow any rooms or spaces between same and the enclosing walls of the building. An open platform not to exceed seventy-two square feet in area may be built before the picture screen. On the main floor of such building there shall be at least two main aisles with direct exits at front and rear and two cross aisles with direct exits from the side. When such building contains a balcony or gallery there shall be emergency exits from the highest and lowest levels of same on one side and on the other side there shall be either emergency exits or enclosed interior stairs from the highest level of the balcony, and the lowest level of the balcony shall be connected with such side stairs by means of a tunnel. All seats in the audience room shall be at least twenty inches wide and spaced thirty-four inches from back to back. The booth for the moving picture machine must be of construction in conformity with the requirements for such machine booths in buildings of Class IVc; in all other respects such buildings shall comply both in structural requirements and equipment with the provisions of the ordinances relating to theatres of Class V hereafter erected.

*Amended June 21, 1912.

Provided, however, that where such building has no balcony or gallery and the seats in the audience room are all on the ground floor of same, and where no portion of the building connected with or made a part of or used in conjunction therewith exceeds two stories in height, and where the lobbies and entrances leading to such part of the building used for purposes of Class IVc have brick dividing walls separating them from the portions of the building connected therewith used for the purpose of any other class as defined in this ordinance, and the floors of said lobbies and entrances and the floors and ceilings above such lobbies and entrances are of fireproof construction and there are no doors or windows leading from such lobbies and entrances to any portion of the said building used for any other purpose than Class IVc, such portion of said building as is not used for purposes of Class IVc may be built in accordance with the provisions of the ordinances designating the manner of construction for such classes.

*Amended (by adding to end of section) February 6, 1913.

333. **Floor Levels—Limitations.)** The following limitations of floor levels shall apply to every building used for the purposes of Class IVc; the highest part of the auditorium floor shall not exceed four feet above the sidewalk level. The floor level at the entrance shall not be at a greater height than eight inches above the sidewalk. The aisles shall not have a greater incline than 1½ inches to the foot.

334. **Stairways.)** Where external stairways are required, such stairways shall be at least six inches wider than the exits, and shall have treads not less than ten inches wide and risers not more than 8 inches high, and shall be provided with suitable handrails on each side thereof, and the width of such stairs shall comply with the requirements of Class IVb.

335. **Balconies and Galleries.)** In non-fireproof buildings hereafter erected for, or converted to the purposes of Class IVc, not more than one balcony and no galleries shall be constructed.

336. **Aisles—Steps and Aisles—Passages to be Kept Unobstructed.)** Aisles and rooms used for the purposes of Class IVc shall have in the aggregate, a width of not less than 20 inches for each 100 of seating capacity of such room and for fractional parts of 100, a proportionate part of 20 inches shall be added, and no aisle shall

have a width of less than two feet six inches. When side emergency exits are permitted, there shall be a cross aisle not less than three feet wide, leading directly to said exit. Steps shall not be permitted in any aisle or in any portion of the auditorium floor. Every aisle, passageway, entrance and exit shall be free from turnstiles, railings or other obstructions.

337. **Corridors — Passageways — Doors — Width Of.)** The width of corridors, passageways and doors shall be computed in the same manner as provided in Sections 311 and 312.

338. **Seats—Size—Location.)** There shall not be more than ten seats in any one row between aisles, nor more than six seats between an aisle and side wall. Seats shall not be less than thirty-two inches from back to back and shall not be less than twenty inches in width measured at the top of the seat back, and shall be secured firmly to the floor.

339. **Exits.)** In every building of Class IVc, there shall be provided at least two entrance doors. No entrance doors shall be less than four feet in width. If the rear of the building abuts upon an alley, there shall be provided not less than two emergency exits leading directly to the said alley. Wherever emergency exits pass over or under the stage floor level, they shall be enclosed with walls of masonry nine inches in thickness, or four-inch hollow tile, or of two-inch solid plaster, composed of iron studs and metal lath and plaster, and shall have floors and ceilings of slow-burning, mill, or fireproof construction. If the side of the auditorium abuts upon a street or alley, such emergency exits shall be located as follows: one exit shall be located at a distance not greater than five feet from the proscenium wall or stage, and the other exit shall be located at a distance half way between the foyer and the stage wall. Exits by means of stairways or stairway fire escapes, equal in width to eighteen inches for each one hundred persons, shall be provided, and for fractional parts of one hundred, proportionate part of eighteen inches shall be added. No such exit shall be less than two feet six inches in width.

340. **Doors to Open Outward.)** All doors affording ingress or egress in buildings of Class IVc shall open outward, and no door shall be less than three feet wide. Such doors, as well as any entrance or exits or opening, shall not be obscured by curtains or draperies, and no door shall be locked or fastened at any time during the time such building is open to the public, and no door or opening shall be less than three feet wide. Such doors shall be so constructed and maintained that they may easily be opened from within.

341. **Walls Between Auditorium and Stage.)** Where the area of the stage exceeds 72 square feet, there shall be provided a proscenium wall of solid masonry of not less than nine inches in thickness, extending from ground to the roof. Where the stage area is less than 72 square feet its proscenium wall may be constructed of two-inch solid plaster walls, composed of metal studs and metal lath and plaster or three-inch hollow tile. In no case shall the underside of ceiling or roof over stage house behind proscenium wall be at a higher level than three feet over the highest point of main proscenium opening. And there shall be no trap doors or other openings in the stage floor.

342. **Curtain.)** (a) The main curtain in the opening of the proscenium wall shall be composed of long fibre asbestos twisted on brass wire and woven into a close cloth. The laps shall be sewed with two lines of brass and asbestos stitching, which laps shall not be less than one-inch wide. Said cloth shall be lapped at least four times around the top and around the bottom bars with at least three lines of the stitching above specified.

(b) The edge of the curtain shall be continuously reinforced by lapping and stitching and also with pieces of sheet metal for clips. The curtain shall be at least thirty inches wider and higher than the masonry opening, and shall have steel top and bottom bars of not less than two square inches in cross section which bars shall be connected by four three-sixteenth-inch steel cables.

(c) There shall be three-eighth-inch spanning cables with upper ends secured to steel brackets fastened to the wall and the lower ends sufficiently counter-weighted to keep the cables taut and where cables pass through the stage floor, the holes shall be metal bushed.

(d) The curtain shall have hard wood eyelets not over eighteen inches center to center, around the standing cables on both vertical edges, which eyelets shall be secured to the curtain by bent brass clips riveted to the curtain with double sheet metal reinforcing.

(e) There shall be steel lifting cables, one-half inch in diameter, at each end of the curtain and at intermediate points not over ten feet apart attached to drums on shafts located above the curtain.

(f) The operating machinery shall be built according to good mechanical engineering practice.

(g) There shall be emergency chains midway between the lifting cables, to hold the curtain which shall be equal in strength and efficiency to the lifting cables.

(h) There shall be steel guides of not less than three-eighth-inch metal on each side of the curtain from the stage floor to the level of the overhead sheaves. The metal guides shall lap the edges of the curtain not less than four inches. The curtain shall be incombustible in all its parts and its operating devices.

(i) The painting and the manner of tripping the curtain and the number of and the location of places for tripping shall be subject to the approval of the Fire Marshal.

(j) A permit shall be obtained from the Department of Buildings for the erection of each such curtain. The Commissioner of Buildings shall inspect each such curtain semi-annually for which semi-annual inspection, a fee of $5.00 shall be charged.

343. **Other Openings in Stage Walls.)** Every other opening in the proscenium wall or in the other walls of the stage shall have self-closing incombustible doors.

344. **Structure Over Ceiling—Construction.)** A structure may be built over the ceiling or roof of any building used wholly or in part for the purposes of Class IVc, provided such space is not used for sleeping or living purposes. Girders or trusses supporting same shall be of steel protected by fireproofing as required in Section 625 and the entire ceiling shall be covered with incombustible material subject to the approval of the Commissioner of Buildings.

345. **Picture Machine Booth.)** The walls, floor and ceiling of every moving picture booth or machine house shall be built of four-inch hollow tile or four-inch solid concrete, supported on iron beams or columns, the door of operating room to be metal clad and swing outwards. There shall be a metal smoke or flue pipe eighteen inches in diameter extending from ceiling to three feet above roof of machine house and terminating in the open air.

346. **Standpipes and Hose on Stage.)** When the stage area exceeds seventy-two square feet and combustible scenery is used

on stage, there shall be a water stand-pipe not less than 1½ inches in diameter with hose connections and hose of sufficient length to reach any and all portions of stage. Said stand-pipe shall be connected to either a fifteen-hundred-gallon frost-proof gravity tank located twenty-five feet above stage level, or to a two-inch city pipe connection, satisfactory to the Fire Marshal.

347. **Vent or Flue Pipe Over Stage.)** (a) When the stage exceeds seventy-two square feet in area and combustible scenery is used, one or more flue pipes of incombustible material and equivalent to one-twentieth of the area of the stage shall be built over the stage and shall extend eight feet above the highest point of roof.

(b) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Marshal, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

348. **Fuse Boxes.)** Every fuse box shall be surrounded by two thicknesses of fireproof material with an air space between, and no fuse shall be exposed to the air between the switch boards; all electrical equipment in such rooms shall be installed and maintained to the satisfaction and approval of the City Electrician.

349. **Capacity—Certification for License.)** The Commissioner of Buildings shall determine the number of persons which every room used for the purposes of Class IVc may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

350. **Exits, Signs and Lights.)** (a) The word "Exit" shall appear in letters six inches high over the openings to every means of egress from such room, and a gas or sperm oil light with red globe shall be provided at or over such exit sign.

(b) Every room used for the purposes of Class IVc and all outlets therefrom leading to the streets, including passageways, courts, corridors, stairways, exits, and emergency stairways, shall have gas or electric lighting equipment to properly illuminate such room and spaces, and every passageway, court, corridor, stairway, exit and emergency stairway, shall be provided with signs indicating the way out of the building, the letters of which, shall not be less than six inches in height.

351. **Lights in Halls, Corridors and Lobbies—Control of—Separate Shutoff—Connection with Gas Mains—Protection of Suspended and Bracket Lights—Protection of Lights Inserted in Walls—Protection of Footlights—Construction of Border Lights, Ducts and Shafts Conducting Heated Air From Lights—Protection of Stage Lights.)** Gas and electric lights in the halls, passageways, corridors, lobbies, and other means of ingress to or egress from any such room shall be controlled by a separate shutoff, located in an accessible place, subject to the approval of the Commissioner of Buildings and controlled only in that particular place. No gas or electric light fixtures shall be inserted in the walls, woodwork, ceilings or in any part of any such room, unless protected by fireproof materials. The footlights, if gas lights, shall be protected by wire net work, and also by a strong wire guard, not less than two feet distant from such footlights, and a trough containing such footlights, shall be formed and be surrounded by fireproof materials. Border lights shall be constructed according to the best known methods subject to the approval of the City Electrician and shall be suspended by a wire rope. Ducts and shafts used for collecting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal, and made double with an intervening air space. Stage lights, if gas, shall have strong wire guards or metal screens, not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of flame, and such guards or screens shall be firmly soldered to the fixtures in all cases.

352. **Apparatus Under Control of Fire Marshal.)** The standpipe, hose, vent flues, and all apparatus for the extinguishing of fire or guarding against same, required by the provisions of this chapter to be provided, shall be at all times so provided and kept in a manner satisfactory to the Fire Marshal.

353. **Scenery Requirements—Fire Proof Solution.)** (a) All scenery on the stage shall be made stationary, and shall consist of not over two asbestos curtains, three stationary wings on each side and four stationary border drops. All scenery and stage paraphernalia shall be treated with a paint or chemical solution every six months, which shall make it non-inflammable, and which treated scenery or stage paraphernalia shall be tested and approved by the Fire Marshal. Where no combustible scenery is used or where all scenery is made of metal, the smoke flue over the stage and the standpipes may be dispensed with at the discretion of the Commissioner of Buildings and the Fire Marshal.

(b) Scenery supported by and constructed entirely of incombustible material, shall not be considered as sets of scenery provided for in this section.

354. **Dressing Room Partitions.)** Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated.

355. **Frontage Consents Required.)** No building of this class shall hereafter be constructed for, or converted to the use of said class, unless frontage consents are secured as required by the ordinances of the City of Chicago and filed with the Commissioner of Buildings.

CLASS IVd

356. **Class IVd Defined.)** In Class IVd shall be included every grand stand and every baseball, athletic and amusement park.

357. **Loads—Allowance for Live Loads.)** The floors and stairs of grand stands and bleacher stands, existing or hereafter built, shall be designed and constructed in such manner as to be capable of bearing in all their parts and supports, in addition to the weight of the floor construction, partitions and permanent fixtures, that may be set upon the same, a live load of not less than one hundred pounds for every square foot of surface of said floors, and a live load of not less than one hundred and fifty pounds for every square foot of the bearing surface of the stairs.

*358. **Grandstands—Frame within Fire Limits—Grandstands Hereafter Constructed**

— **Fireproof — Frontage Consents.)** (a) *Wooden grandstands or tiers of seats commonly known and described as grandstands now constructed or in the process of construction may be erected, repaired or enlarged within the fire limits where no part of any such structure shall be within sixty feet of any other building or structure. All grandstands hereafter erected within the fire limits, except as hereinafter provided, shall be made of fireproof or unprotected steel construction. The enclosing walls, if enclosed, shall be made of fireproof or incombustible materials, but the seats may be made of wood. Grandstands outside the fire limits, or inside the fire limits where the seating capacity does not exceed five thousand persons, may be constructed of wood, but no part of any such structure shall be within less than sixty feet of any other building or structure. The braces, supports and the underside of all seats, including bleacher seats, shall be treated with a fire-retarding solution once a year before opening up the premises containing such stand to the public.*

(b) *Every person, firm or corporation desiring a permit for the construction of a grandstand, except in connection with such as are now in existence, shall first obtain the consent in writing of the owners of a majority of the frontage on both sides of the street or streets on each side of the block or square in which it is desired to erect such grandstand.*

*Amended, Dec. 19, 1910.

359. **Width of Aisles and Exits—Number of Seats Between Aisles.)** (a) The width of aisles and exits in all grandstands contemplated in Section 356, hereafter constructed, shall be in no case less than 36 inches and such width shall be increased toward the exits which serve as regular entrances, such width being computed at the rate of eighteen inches per 100 seats or fractional part thereof in non-fireproof grandstands, and at the rate of twelve inches for each 100 seats or fractional part thereof in fireproof grandstands.

(b) The number of seats between aisles in any row shall not exceed twenty in non-fireproof grandstands, nor thirty in fireproof grandstands.

(c) No exit, gate or door, shall be locked or bolted during the occupancy of such stands by the public. All aisles, passageways, corridors and exits shall be kept free from obstructions of any kind.

360. **Temporary Seating Structures.)** Temporary seating structures for shows and outdoor exhibitions and the observation of holidays and special occasions may be built of combustile material, providing they are built structurally strong enough to support a live load of one hundred pounds per square foot, and comply with the provisions of Class IVb in regard to means of exit, aisles and rows of seats; and provided, further, that a permit be secured from the Commissioner of Buildings, which shall in no case be issued by him until the party desiring to erect said temporary seating structure shall secure the written consent of a majority of the property owners or their duly authorized agents, on both sides of the street between the two nearest intersecting streets on which said temporary seating struction is to be located. And further provided that any permit issued for any such temporary seating structure as hereinabove provided for in this section shall not entitle the person so receiving said permit to use said temporary seating structure for more than ten consecutive days from the first day on which it is so used; and further provided that any temporary seating structure provided for in this section shall be removed within ten days after the use of the same as provided for in this section, and if not so removed it shall be the duty of the Commissioner of Buildings to order the same to be removed or torn down by the Fire Marshal.

361. **Use of Roofs Used for Spectatorial Purposes—Prohibited.)** It shall be unlawful for any person, firm or corporation whether owner, lessee, manager or in possession and control or having charge of any building within the city to permit the use of the roof of any such building, whether free of charge, or through admission fee, to any person or persons as a place of observation or for spectatorial purposes

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Amusement Parks.

362. **Roller Coaster Devices.)** No roller coaster, scenic railway, or other riding, sliding, or rolling device, shall be hereafter erected of a greater height from the ground than 55 feet. All such coasters, railways, riding or other devices shall be equipped with safety clutches. The cars, or any receptacles, which persons are permitted to occupy, or in which they are permitted to travel, ascend or descend, shall have hand rails of sufficient number and height to prevent people from being thrown therefrom, and of such character as shall be approved by the Commissioner of Buildings.

363. **Frontage Consents Required.)** It shall hereafter be unlawful for any person, firm or corporation, to build, construct, establish, produce or carry on, any amusement within any ground, garden or enclosure of the kind commonly known and described as amusement parks, wherein shows of different classes are offered or presented by one or more concessionaries, without first securing written frontage consents as required by the ordinances of the City of Chicago. Such frontage consents shall be filed with the Commissioner of Buildings before a permit shall be issued for the construction of any building or structure connected in any way with such amusement park.

*364. **Requirements.)** (a) Buildings hereafter erected within an amusement park, located outside the fire limits, shall comply, except as herein otherwise specified, with the provisions of Class IVb.

(b) Buildings hereafter erected within amusement parks located outside of the fire limits and not exceeding one story in height and which do not contain more than one balcony may be built with a self-supporting steel frame designed as required by this chapter. Such structures may be enclosed with metal lath covered with cement plaster, which plaster shall be not less than one and one-third inches thick, or such structures may be enclosed with galvanized iron. The roofs of such structures may be of ordinary construction supported on steel trusses and covered with a gravel or composition roof, approved by the Commissioner of Buildings.

(c) Every moving picture theatre *hereafter* built within an amusement park shall comply with the provisions of Class IVc.

*Amended June 26, 1911.

365. **Open Space Between Buildings.)** There shall be an open and unobstructed space of not less than four feet between each and every frame building hereafter erected in an amusement park, where the buildings do not exceed twenty feet in height, and of not less than six feet where the buildings are over twenty feet and less than thirty feet in height, and of not less than ten feet where the buildings are over thirty feet in height. Where brick or concrete or other fireproof walls of full seventeen inches in thickness are used between such buildings and where such buildings are built of slow-burning construction, these spaces shall not be required, but, in such cases, there shall be a space of ten feet in width at intervals of every two hundred feet.

366. **Standpipes — Fire Plugs — Hose.)** There shall be installed within the grounds of every amusement park, an adequate system of water pipes with branch connection to fire plug, with sufficient hose connected to city pressure, so as to furnish at all times a good and efficient force of water, which will enable the extinguishing of fire at or within each and every building. The size of water mains, standpipes, fire plugs, hose, as well as the location, number, and quantity of same, shall be subject to the approval of the Fire Marshal. All hose connection shall be the standard size used by the Fire Department of Chicago and shall be approved by the Fire Marshal.

367. **Roller Coasters—Scenic Railways, Etc.—Permit Fee—Certificate of Test and Safety.)** Before any roller coaster, scenic railway, water chute, or other mechanical, riding, sailing, sliding or swinging device is erected, either in existing or new amusement parks, a detailed plan shall be submitted to the Commissioner of Buildings, for his approval or rejection, and, if approved, a permit shall be procured by the person, firm or corporation desiring to erect such device. The permit fee shall be fifty dollars for each such device. Before such device is opened to the public each season, a certificate of inspection, signed by a competent engineer, approved by the Commissioner of Buildings, must be furnished, certifying to the practicability, strength and safety of such devices, and all such device or devices shall be examined by the Commissioner of Buildings or his employees upon completion and each year before opening up to the public.

368. **Must Comply With All Ordinances.)** It shall be unlawful for any person, firm or corporation to construct, alter or operate any amusement park or any building or structure therein unless they comply with the ordinances of the city relative thereunto.

ARTICLE VIII.

(NOTE: *See end of ordinance, page 161 for special ordinance on regulations for operating places of amusement.*)

Class V.

369. **Class V Defined.)** In Class V shall be included every building which is used as a public theater where an admission fee is charged and in which movable scenery is used, and every assembly hall hereafter erected having a seating capacity of over 300 and containing a permanent stage on which scenery and theatrical apparatus are used and regular theatrical vaudeville performances are given; provided, however, that public halls and club halls with a seating capacity of less than six hundred, although occasionally used for theatrical presentation, shall not be considered as public theatres within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stages thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V as herein defined. Such public halls and club halls shall be included in Class IV as defined in this section.

369½ **Must Comply With General and Special Provisions.)** Every building of Class V shall comply with the general provisions of this chapter and shall also comply with the following special provisions:

370. **City Officers Empowered to Enter Buildings.)** The Commissioner of Buildings, Commissioner of Health. Fire Marshal, City Electrician, Superintendent of Police, or any of them, and their respective assistants, shall have the right to enter any building used wholly or in part for the purposes of Class V, and any and all parts thereof, at any reasonable time, and at any time when occupied by the public, in order to examine such buildings, to judge of the condition of the same and to discharge their respective duties, and it shall be unlawful for any person to interfere with them, or any of them, in the performance of their duties.

371. **City Officers Empowered to Close.)** The Commissioner of Buildings, Commissioner of Health, Fire Marshal, City Electrician and the Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Class V, closed, where it is discovered that there is any violation of any of the provisions of the chapter, and keep same closed until such provisions are complied with.

372. **License — Mayor Shall Revoke.)** Upon a report to the Mayor by the Commissioner of Buildings, Commissioner of Health, Fire Marshal, City Electrician or the Superintendent of Police that any requirement of this chapter or that any order given by them or any of them in regard thereto has been violated, or not complied with, the Mayor shall revoke the license of any such theatre or place of amusement so reported and cause the same to be closed.

Buildings of Class V Now in Existence.

373. **Buildings of Class V Now in Existence.)** The following provisions shall apply to Class V buildings in existence at the time of the passage of this ordinance:

374. **Walls—Outside—Must Comply with Requirements of Section 519.)** The outside walls of all such buildings in existence at the time of the passage of this ordinance, the roofs or ceilings of which are carried on trusses or girders of a span of fifty feet or more shall comply with the requirements of Section 519.

375. **Columns in Walls—Alterations.)** If iron or steel columns are introduced in the walls referred to in Section 374, the brick work around the same shall be bonded into that of the connecting walls, and each of such columns shall be fireproofed as provided in Sections 624 and 625 of this chapter. All alterations in such existing buildings, to make them comply with the requirements of this chapter may be executed with the same kind of materials as those originally used in the construction of such buildings; provided, that after the said building is brought into compliance with the provisions of this chapter, then all subsequent alterations, enlargements, repairs, replaced or strengthened structural parts damaged by fire, wear and tear, or otherwise, shall be made of fireproof construction or iron or steel construction covered with fireproof materials, as provided by this chapter.

376. **Other Classes Built in Conjunction with Class V—Doors for Openings Between Connecting Buildings.)** In all cases where existing buildings used wholly or in part for the purposes of Class V are built in conjunction with or as part of buildings devoted to the uses of other classes and where such buildings of the other classes, as specified in this ordinance, are not built entirely of fireproof construction, double iron doors shall be placed at each connecting opening between such buildings of Class V and the building connected therewith.

*377. **Floor Levels—Limitations of.)** (a) Any audience room used for the purposes of Class V *now in existence* containing in the aggregate not more than five hundred seats, if in a fireproof building, may be *maintained* in any story thereof, but in such case there shall be at least two stairways to the

ground, from the floor or floors on which each such room is located, each of which stairways shall be not less than four feet in width in the clear.

(b) In existing buildings of fireproof construction, having an audience room with a seating capacity of more than five hundred and less than fifteen hundred, the lowest bank of seats of the main floor thereof shall be not more than twelve feet above the street level, and every such building shall in all other respects conform to the requirements of this ordinance. The main floor of *any existing theatre of any kind of construction shall not be raised above its present elevation.*

*Amended July 22, 1912.

378. **Loads—Allowance for Live Loads in Construction of Floors of Class V.)** For all buildings of Class V all floors shall be designed and constructed in such manner as to be capable of supporting in all their parts, in addition to the weight of floor construction, partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

379. **Stairways—Entrances and Exits.)** (a) Stairways, affording egress from any room or rooms used for the purposes of Class V shall be equivalent in width to twenty inches for every one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches shall be added, but no such stairway shall be less than four feet wide in the clear, except as hereinafter provided in this section.

(b) All such stairways shall have hand railings on each side thereof and shall not ascend to a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall not be less than the width of the stairs. No run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over 7 feet wide shall have double intermediate handrails with end newel posts at least 5½ feet high.

(c) Steps shall not have a greater rise than 8 inches, treads shall not be narrower than 10 inches, and winders shall not be used on any staircase, except where circular staircases are expressly permitted.

(d) In existing theatres every balcony and gallery shall have separate and distinct entrance stairways from the sidewalk level, except that in cases where the vestibule or entrance to any such theatre is not more than fifteen inches, or two steps, above the sidewalk level and such steps are at or near the building line, the stairways to such balcony and gallery may ascend from the floor of such vestibule or entrance, but if the run of the stairs at the bottom is not toward the street, there shall be a hand rail or rails, three feet above the floor constructed from the foot of such stairways for a distance of not less than five feet leading toward the street. All doors intervening between such stairways and the street shall, during each and every performance, be kept unfastened.

(e) There shall be an iron stairway or stairways from the stage to the fly galleries and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairways may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

(f) Every stairway leading to a box or boxes shall be independent of all other stairs or seats; and such stairway shall not be less than two feet eight inches wide in the clear, when such box or boxes seat not to exceed thirty people, and an additional width of one inch shall be added to such stairway for each additional five persons for whom seating capacity is provided.

(g) Every stairway on the stage side of the proscenium wall shall be not less than two feet six inches wide.

(h) Instead of increasing the width required for entrances, aisles, exits and stairways to that required by this chapter, the owner, lessee or manager of any such theatre shall have the privilege of reducing the number of permanent seats therein until the same ratio between such width and number of seats as hereinbefore provided for shall be established, and if such privilege be taken advantage of, it shall be the duty of the Commissioner of Buildings to make inspection and certify that such ratio actually exists before a license for the operation of any such theatre shall be issued.

380. **Floors and Exits.)** Floors at all exits shall be level and flush with adjacent inside floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

381. **Seats in Rows Between Aisles.)** (a) Not more than ten seats in any row shall be permitted between aisles in any gallery. On the main floor and balcony not more than eleven seats shall be permitted between aisles; except in rows of seats which are within twenty feet from the exits, in which case thirteen seats shall be permitted between aisles.

(b) Seats shall be not less than twenty inches in width measured at the top of the seat backs. Rows of seats shall be not less than two feet eight inches from back to back.

No bank of seats shall be of greater rise than twenty-two inches.

(c) All groups of seats shall be so arranged that there shall be an aisle at each side of each group, except that groups of five seats or less may abut upon a tunnel at one side and an aisle at the other. And except that a bank of seats abutting boxes or walls on main floor, balcony, and gallery, of not over five seats in a row, shall be required to abut upon one aisle only.

(d) The number of banks of seats on the main floor shall not exceed fifteen unless an intervening or cross aisle is provided between each fifteen banks of seats or unless a direct exit is provided for each aisle.

(e) The number of banks of seats in the balcony shall not exceed nine unless an intervening or cross aisle is provided between each nine banks of seats or unless a direct exit be provided for each aisle.

382. **Tunnels—Cross Aisles—Vertical Rise—Foyer.)** (a) There shall be no more than twelve-feet rise measured vertically in any aisle in any gallery without a direct exit by tunnel or otherwise to a corridor with free opening on to the gallery stairs or other direct discharge to the street, or at such elevation of twelve feet an intervening or cross aisle leading directly to an exit. No tunnel shall be less than three feet wide in the clear.

(b) No foyer shall be open to the theatre proper except through the exits.

383. **Main Floor—Balcony and Gallery—Designation of.)** (a) The lower floor of all theatres shall be designated the "Main Floor."

(b) Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony," and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery."

384. **Aisles, Corridors and Passageways—Kept Unobstructed—Steps in Aisles.)** (a) The minimum width of aisles with diverging sides in any room used for the purposes of Class V shall be two feet eight inches at the end near the stage and not less than three feet at the other end.

(b) The minimum width of aisles with parallel sides shall be three feet.

(c) Every aisle shall lead as nearly as possible directly to an exit, but in no case shall the center line of such exit be more than three feet from the center line of any such aisle leading thereto.

(d) Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be greater than 8 inches, and no tread shall be less than 10 inches, and whenever the rise from bank to bank of seats is less than five inches, the floor of the aisles shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be isolated, but shall be grouped together and a light shall be maintained so that every place where there are steps in inclosing aisles or corridors shall be clearly lighted.

(e) All aisles passageways, corridors and exits shall be kept free from camp stools, chairs, sofas and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles, passageways, corridors or exits during any performance, service, exhibition, lecture, concert or any public assemblage.

385. **Corridors, Passageways, Hallways and Doors—Width of.)** (a) The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting, however, that no corridor shall be anywhere less than four feet in width, and no door less than three feet wide, except as otherwise herein provided.

(b) All corridors, passageways, hallways and stairways leading from any balcony or gallery to any toilet room, retiring room, smoking room, check room or private office, shall lead directly to an outer exit of the building. Such corridors, passageways, hallways and stairways shall be at least three feet in width in every part, and shall be unobstructed in every part except by doors, not less than three feet in width in the clear, which shall swing outward and which shall not have locks or catches of any kind whatever.

386. **Doors—Entrance.)** (a) The width of entrance doors to every theatre shall be computed on the basis of twenty inches in the clear to each one hundred permanent seats in the audience room and in addition thereto a proportionate part of twenty inches for the fractional part of one hundred seats shall be added.

(b) No mirror or architectural feature shall be so arranged as to give the appearance of a doorway, exit, hallway or corridor where none exists.

387. **Dressing Room Partitions.)** Partitions forming dressing rooms, except where already built, shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated.

388. **Emergency Exits—Width—Emergency Stairs—Width—Emergency Exits Inside Walls of Buildings—Fire Escapes, Construction—Fire Escapes Leading to Street or Alley—Doors Open Outward.)** (a) Emergency exits and stairways shall be provided separately for each door, balcony and gallery and shall be of the same aggregate width as that provided for the main exits, and shall not be less than three feet in width. Such emergency exits shall be kept free of obstructions of every kind, including snow and ice.

(b) Such emergency exits and stairways may be built inside the walls of the building, provided they are enclosed by a fireproof partition not less than four inches thick separating the exits and stairways from the audience room or auditorium.

(c) If said emergency exits lead outside the building, the opening leading thereto shall have metal doors with wired glass panels. The doors shall open outward, and shall be hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of the wall. Outside shutters will not be permitted, except when they open automatically from the interior, without resistance, and when used or open will automatically fasten, securely, flat against the wall, so as not to obstruct the passage on the outside; all such automatic devices or attachments to said doors or shutters shall be subject to the approval of the Commissioner of Buildings and the Fire Marshal of the City of Chicago.

(d) Whenever any such emergency stairway passes over an exit door, window or other opening, such stairway shall be completely inclosed for a space of five feet greater in width than such opening, by iron, steel or other incombustible material.

(e) All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any doors, gates, bars or obstruction of any character.

(f) Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley, or street, without entering into or passing through or over any building unless by a fireproof passage at least four feet wide and seven feet high on the court or ground level.

(g) All doors in openings from any and all exits and stairways shall be so constructed that when opened they shall not obstruct any portion of any other doorway, opening or passageway.

(h) All doors affording ingress to or egress from any theatre shall open outward and such doors shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

389. **Wall—Brick Proscenium Wall Between Auditorium and Stage—Steel Curtain Fireproofed on Stage Side—No Combustible Material on Audience Side—Plans for Curtains—Permit from Building Department—Inspection Fee.)** (a) There shall be in every theatre a solid brick wall of the same construction and thickness as is required in outside walls between the auditorium and the stage. The main proscenium opening shall have a substantial steel curtain vertically operated and fireproofed on the stage side, which shall be raised and lowered by mechanical power and shall be in constant use as the regular curtain and act drop. In vaudeville houses said curtain shall be lowered at least once during each performance.

(b) No combustible material other than painted decorations shall be applied to the audience side of such curtains.

(c) Plans for such curtains shall be approved by the Commissioner of Buildings and a permit obtained previous to its erection. The Commissioner of Buildings shall inspect such curtain semi-annually, for which inspection a fee of five dollars shall be charged.

(d) All other openings in such proscenium wall shall have iron doors, frames and thresholds.

390. **Stage—Construction of—Fireproof Paint—Scenery—How Treated.)** (a) The framing of the floor of every stage shall be of iron or steel. The stage floor may be of wood not less than one and three-fourths inches thick, and the under side of stage floor shall be saturated with a fireproof solution satisfactory to the Fire Marshal. The entire floor construction and floor of fly galleries, rigging lofts and paint gallery, all railings and supports and stanchions thereon, and all sheaves, pulleys and cables, and their supports, shall be of iron or steel. All woodwork and all framing for scenery used on or about the stage shall also be saturated with a fireproof solution, the same as prescribed for stage flooring.

(b) Counter weighting of scenery must be done with incombustible weights carried on steel cables and operated in grooves or slotted channels; except that small sandbags, weighing not over eight pounds, may be used to bring down scenery ropes to stage level.

(c) No scenery or stage paraphernalia of any sort shall be used upon the stage of any room used for theatrical purposes, unless such scenery and paraphernalia shall have been treated with a fireproof or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

391. **Vestibule for Stage Doors.)** All doorways and openings in the rear or sides of the stage shall be vestibuled or arranged in a manner satisfactory to the Commissioner of Buildings so as to protect the curtain, scenery and auditorium against draughts of air.

392. **Vents—Flue Pipes, Size of—Dampers—Switches for Dampers.)** (a) One or more vents, or flue pipes, of metal construction or other incombustible material, suitable for carrying away smoke, approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional stories.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Marshal, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

(d) All fuse boxes shall be surrounded by two thicknesses of fireproof material, with an air space between, and no fuses shall be exposed to the air between the switch board.

393. **Automatic Sprinklers—Location of—Tank—Connections.)** (a) An approved system of automatic sprinklers shall be provided in every theatre of this class, with approved automatic closed circuit electric devices, connecting the valves regulating the flow of water in the various sprinkler pipes, with the headquarters of the city fire alarm telegraph and such other place or places as the Fire Marshal shall direct, so arranged as to prevent any tampering with the system or the shutting off of the water from the sprinkler pipes, without automatic notice to the Fire Department.

(b) Such system of automatic sprinklers shall be supplied with water from a tank located not less than twenty feet above the level of the highest sprinkler head in the system, and it shall be the duty of the fireman provided for in this ordinance to include in his daily report the result of an inspection to determine the sufficiency of water in this tank. Automatic sprinklers shall be placed in the paint room, store room, property room, scene-storage room, carpenter shop and dressing rooms. If such rooms are in or connected with a building used for the purposes of Class V, such tank shall not be connected with a standpipe and ladder system, but shall be filled through a separate pipe from a fire pump, and a three-inch iron pipe shall extend from such tank to the outside of such building, with Siamese connections, for fire department use. Such entire automatic sprinkler system and equipment and the location thereof shall be subject to the approval of the Fire Marshal.

*394. **Fire Apparatus on Stage—Hand Fire Pumps—Fire Apparatus.)**. (a) A standpipe not less than two and a half inches in diameter, having a hose valve or valves thereon, shall be installed on each side of the stage, with a hose connection at the stage and at each floor above and below the stage. Such standpipes shall be connected with a frost protected tank on the roof, containing not less than 3,000 gallons of water, and also with a power pump. A length of approved one and one-half inch unlined linen hose, with five-eighths inch smooth bore nozzle, shall be attached to each outlet. Hose, when not in use, shall be mounted on self-releasing racks of approved pattern. Approved portable fire extinguishers or hand fire pumps, shall always be kept ready for use on and under the stage, in fly galleries and in rigging lofts, and, in addition thereto, at least four fire department axes and six pike poles shall be kept ready for use on each tier or floor of the stage.

(b)

*Amended October 30, 1911, by striking out paragraph (b).

(c) All of the above mentioned equipment shall be installed and maintained under the direction of and subject to the approval of the Fire Marshal.

(d) The use of ordinary hot-air furnaces or stoves is prohibited.

395. **Lighting—Independent Lighting System for Exits—Red Lights Over Exits.)** (a) All stairways and corridors shall be supplied with a supplementary lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building and shall be in operation during the entire period such theatre is open to the public and until the audience has left the building. The word "EXIT" shall appear in letters at least six inches high over the opening to every means of egress from such theatre and a red light furnished by gas or sperm oil shall be provided over such sign.

(b) In every theatre, every portion thereof devoted to the use or accommodation of the public, and all outlets therefrom leading to the streets, including open courts, corridors, stairways, exits and emergency stairways, shall have gas or electric lighting

equipment to properly illuminate such rooms and spaces, and every passageway, court, corridor, stairway, exit and emergency stairway shall be provided with signs indicating the way out of the building, the letters of which shall not be less than six inches in height.

396. **Lights—Control of Lights in Halls, Corridors and Lobbies—Separate Shut-off—Connections with Gas Mains—Independent Connections—Protection of Suspended and Bracket Lights—Protection of Lights Inserted in Walls—Protection of Footlights—Construction of Border Lights—Ducts and Shafts Conducting Heated Air from Lights—Gas Stage Lights to Have Metal Screens.)** Gas and electric lights in the halls, corridors, lobbies or any other part of any theatre used by the audience, except the auditorium, shall be controlled by a separate shut-off, located in the lobby, and controlled only in that particular place. Gas mains supplying such theatre shall have independent connections for the auditorium and the stage, and provisions shall be made for shutting off the gas from the outside of the building. Suspended or bracket lights surrounded by glass in the auditorium, or in any other part of the theatre, shall be provided with proper wire netting underneath. No gas or electric lights shall be inserted in the walls, woodwork, ceilings, or in any part of the theatre, unless protected by fireproof materials. Border lights shall be constructed according to the best known method and subject to the approval of the Fire Marshal and the City Electrician, and shall be suspended by wire rope. Ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double, with an air space between. Gas stage lights shall have strong metal wire guards or screens not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of the flames of such lights, and shall be soldered to the fixtures in all cases.

397. **Fire Apparatus—Under Control of Fire Department.)** The standpipes, automatic sprinklers, gas pipes, electric wires, hose, footlights, fire alarm boxes, fireproof proscenium curtain, switch boxes, ventilators, controlling levers, axes and pike poles, and all apparatus for the extinguishing of fire or guarding against the same, as provided for by this ordinance, shall be made and kept at all times in condition satisfactory to and under the control of the Fire Marshal.

398. **Fire Alarm Apparatus.)** Every theatre shall be provided with an approved system of automatic or manual fire alarm telegraph apparatus connected by the necessary wires with the headquarters of the city fire alarm telegraph and such other place or places as the Fire Marshal may direct. The number and location of the boxes and the character of the system, whether automatic or manual, or both, shall be determined by the Fire Marshal.

399. **Capacity—Certification for License.)** The Commissioner of Buildings shall determine the number of persons which every room used for the purpose of Class V may accommodate according to the provisions of this chapter and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

*400. **Theatres in Frame Buildings Prohibited.)** On and after *July* first, 1911, no frame building, or part thereof, within the city, shall be used as a moving picture, vaudeville or other theater; *provided, that nothing herein contained shall be held to apply to any frame building existing at the time of the passage of this ordinance and in which a moving picture, vaudeville or other theater is being maintained at the time of the passage of this ordinance, where all the scenery, if any, used in connection with such moving picture, vaudeville or other theater, is constructed of either sheet-metal or asbestos, and where the amount of exit space for such theater is at least fifty (50) inches for each one hundred (100) seats therein contained, and where there is no living apartment of any kind used, maintained or occupied as such in any part of said building.*

*Amended June 26, 1911.

To Buildings of Class V Hereafter Erected.

The following provisions shall apply to buildings of Class V hereafter erected and used wholly or in part for such purposes:

401. **Construction—Walls—Outside Walls—Structures.)** All buildings of Class V hereafter erected shall be built of fireproof construction.

402. **Frontage—Open Spaces—Fireproof Passageways.)** (a) All buildings hereafter erected used wholly or in part for the purposes of Class V shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street and the other may be a public alley not less than ten (10) feet in width.

(b) The audience room of every such building used for the purposes of Class V shall have either a public thoroughfare or an open space not less than ten feet wide extending from the lowest first floor level to the sky, on each of the two sides other than the proscenium and the foyer. Exit doors shall open onto such public thoroughfare or the bottom of such open space from the respective sides of the stage and of the main floor of the audience room, and onto balconies or platforms built in such public thoroughfare or open space at both the highest and the lowest floor levels of each and every balcony and gallery and the doors opening into such public thoroughfare or open space from any balcony or gallery or from the main floor shall comply with all the requirements prescribed in Section 410 of this chapter.

(c) All such balconies or platforms shall be connected with stairway fire escapes leading to the street level or to the bottom of such open space and in the latter case they shall have their bottom run toward the public thoroughfare and such balconies or platforms and such fire escapes shall comply with all the requirements prescribed in Sections 669, 670 and 673 of this chapter. Every such open space, if it does not open into a public thoroughfare shall communicate with the public thoroughfare at the front side of the theatre by a fireproof passageway leading from the bottom level of such open space to the sidewalk level. Where there is a public thoroughfare behind the stage every such open space shall also communicate with such public thoroughfare by a fireproof passageway leading from the bottom level of such open space to the level of the public thoroughfare behind the stage, and passing under the stage.

(d) The walls of a fireproof passageway shall be not less than four inches thick, and each and every part of such passageway, including each and all of its supports, shall be built of fireproof construction as required in the general provisions of this chapter relating thereto.

(e) Radiators for warming passageways shall be in recesses sufficient in depth to prevent them from obstructing the passageway.

(f) There shall be no steps or risers in fireproof passageways, but where necessary, inclined floors of the full width of the fireof the floor shall not exceed two and one-half inches in height per foot measured horizontally, and no such incline shall be

proof passageway may be built; the incline less than ten feet in length. No fireproof passageway shall be less than ten feet wide and eight feet high in any part thereof except at doors, and these door openings shall be not less than eight feet wide and seven feet high.

(g) If the principal entrance corridor of a theatre is at one side and approximately at right angles to the central axis of the audience room, then the center line extended of such principal entrance shall intersect the center axis of the stage and the audience room between the back of the seat most remote from the stage, on said center axis of the stage and the audience room and at a point midway between such seat and the wall opposite the proscenium wall.

403. **Buildings of Other Classes Built in Conjunction with Class V.)** If buildings used wholly or in part for purposes of Class V, are built in conjunction with or as part of buildings devoted to the uses of other classes, then such buildings of other classes shall be built of fireproof construction.

*404. **Floor Levels—Live Loads.)** *(a) The floor level of the highest bank of seats on the main floor shall not be more than three feet above the sidewalk level and the floor level of the lowest bank of seats shall not be more than eight feet below the sidewalk level.*

(b) All floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, permanent fixtures and mechanisms that may set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

*Amended July 22, 1912.

405. **Stairways—Entrances and Exits.)** (a) Stairways affording ingress to or egress from any room used for the purposes of Class V shall be in width equivalent to twenty inches for each one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches of width shall be added, but in no event shall any such stairways be less than four feet in the clear, except as hereinafter provided.

(b) All such stairways shall have hand rails on each side thereof, and shall not ascend to a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall be not less than the width of the stairs; no run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over seven feet wide shall have double intermediate hand rails with end newel posts at least five and one-half feet high.

(c) Steps shall not have a greater rise than eight inches, treads shall not be narrower than eleven inches, and winders shall not be used on any staircase.

(d) Every balcony and gallery shall have one or more separate and distinct exits and stairways to the sidewalk level. All gallery stairways shall lead to the top gallery and there shall be doors in same at each floor for exit purposes only. The bottom run of the stairs shall be directly toward the street. Such stairs may ascend from the vestibule or entrance inside of the buildings, but the bottom riser of such stairs shall be not more than sixty-five feet from the building line. All doors between such stairs and the street shall be kept unlocked and unfastened during each and every performance and until the audience has left the building.

(e) There shall be an iron stairway or stairways from the stage to the fly gallery and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairway may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

(f) Stairs leading to a box or boxes seating not to exceed thirty people in the aggregate shall be independent of all other stairs and seats, and not less than two feet eight inches wide in the clear. For each additional twenty-five persons for whom seating capacity is provided, or major portion thereof, in such box or boxes there shall be an additional five inches in width of such stairway.

(g) All stairways on the stage side of the proscenium wall shall be not less than two feet six inches wide.

406. **Floors at Exits — Seating.)** (a) Floors at all exits shall be level and flush with adjacent inside floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

(b) There shall not be more than ten seats in any one row between aisles.

(c) Seats shall not be less than twenty-two inches in width, measured at the top of the seat backs.

(d) Rows of seats shall not be less than two feet ten inches from back to back.

(e) No bank of seats shall have a greater rise than twenty inches. A bank of seats abutting boxes or wall on main floor, balcony or gallery of not over five seats in a row, shall be required to abut upon one aisle only.

(f) Seats in loges and boxes shall be limited in the ratio of one seat for every six hundred and eighty square inches of floor area in such loge or box.

(g) All groups of seats shall be so arranged that there shall be an aisle at each side of each group, provided groups of five seats or less may abut upon a tunnel at one side and an aisle on the other side.

(h) The number of banks of seats on the main floor shall not exceed fifteen, unless an intervening or cross aisle is provided between each fifteen banks of seats or a direct exit is provided for each aisle. The number of banks of seats in the "balcony" and "galleries" shall not exceed nine, unless an intervening or cross aisle is provided between each nine banks of seats or a direct exit is provided for each aisle.

407. **Tunnels—Cross Aisles—Vertical Rise—Foyer.)** (a) There shall be no more than eleven feet rise, measured vertically, in any aisle in any gallery without a direct exit by tunnel or otherwise, to a corridor with free opening onto the gallery stairs or other direct discharge to the street or at any such elevation of eleven feet an intervening or cross aisle leading directly to an exit. No tunnel shall be less than four feet wide in the clear.

(b) No foyer shall be open to the theater proper except through the exits.

408. **Main Floor Balcony and Gallery—Designation of.)** (a) The lower floor shall be designated the "Main Floor."

(b) Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony" and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery."

409. **Aisles and Passageways—Steps in Aisles.)** (a) The minimum width of aisles with divergent sides in any room used for the purpose of Class V shall be two feet eight inches at the end nearest the stage and not less than three feet at the other end. The minimum width of aisles with parallel sides shall be three feet.

(b) Every aisle shall lead directly to an exit. Any exit located at the end of any aisle and at right angles thereto shall be considered a direct exit.

(c) Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be more than eight inches in height, and no tread shall be less than ten inches in width, and whenever the rise from bank to bank of seats is less than five inches, the floor of the aisle shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be inclosed but shall be grouped together, and a light shall be maintained so that every place where there are steps in inclosing aisles or corridors shall be clearly lighted.

410. **Corridors—Passageways—Hallways and Doors—Width of.** (a) The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting however, that no corridors shall be less than five feet in width and no doorway less than three feet wide, except as otherwise herein provided.

(b) All corridors, passageways, hallways and stairways leading from any balcony or gallery to any toilet room, retiring room, smoking room, cloak room, check room, or private office, shall permit of free passage, without returning, to an outer exit of the building. Such corridors, passageways, hallways and stairways shall be at least four feet in width in every part between such balcony or gallery and such outer exit, and shall be unobstructed in every part, except by doors not less than three feet in width in the clear, which shall swing outward and which shall not be provided with locks or catches of any kind whatever.

(c) The width of entrance doors to every theatre shall be computed on the basis of twenty inches in the clear to each 100 permanent seats in the audience room, and in addition thereto a proportionate part of twenty inches for the fractional part of 100 seats remaining shall be added.

(d) No mirror or architectural feature shall be so arranged as to give the appearance of a doorway, window, exit, hallway or corridor where none exists.

411. **Emergency Exits—Width—Emergency Stairs, Width—Emergency Exits Inside Walls of Buildings—Fire Escapes, Construction—Fire Escapes Leading to Street or Alley—Doors Open Outward.)** (a) Emergency exits and stairways shall be provided separately for each floor, balcony or gallery and shall be of the same aggregate width as that provided for the main exits, and shall not be less than three feet in width. Such emergency stairway shall be made of iron, steel or other incombustible material. Such emergency exit shall be kept free of obstructions of every kind, including snow and ice.

(b) Such emergency exits and stairways may be built inside the walls of the building, provided they are enclosed by a fireproof partition not less than four inches thick, separating the exits and stairways from the audience room or auditorium.

(c) If such emergency exits lead outside the building, the openings leading thereto shall have metal doors with wired glass panels. The doors shall open outward, and shall be hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of the wall, and outer shutters shall not be permitted.

(d) Whenever any such emergency stairway passes over an exit, door, window or other opening, such stairway shall be completely inclosed for a space of five feet greater in width than such opening, by iron, steel or other incombustible material.

(e) All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any door, gate, bars or obstruction of any character.

(f) Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley or street without entering into or passing through or over any building unless by a four-foot wide fireproof passage on the court or ground level.

(g) All doors in openings from emergency exits and stairways shall be so constructed that when opened they will not obstruct any portion of any other doorway, opening or passageway.

(h) All doors affording ingress to or egress from any theatre shall open outward and shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

412. **Wall—Brick Proscenium Between Auditorium and Stage—Steel Curtain Fireproofed on Stage Side—No Combustible Material on Audience Side—Plans for Curtain—Permit from Building Department.)** (a) There shall be a solid masonry wall of the same construction and thickness as is required in the outside walls of the building in which such theatre is located between the auditorium and the stage.

(b) The main proscenium opening shall have a vertically operated steel curtain which shall, when it is lowered, completely close such proscenium opening. The curtain shall be raised and lowered by hydraulic power, and shall be in constant use as the regular curtain and act drop. In vaudeville houses said curtain shall be lowered at least once during the performances.

(c) The lowering of the curtain shall be controlled from not less than two points in the building, one of which shall be from the stage level and the other shall be designated by the Commissioner of Buildings.

(d) The curtain shall have a steel covering on the outer or auditorium side. The stage side covering shall be of a non-heat-conducting substance of such a thickness and such material as shall stand a test of two thousand degrees Fahrenheit on the stage side for fifteen minutes without heating the opposite side to a higher temperature than three hundred and fifty degrees Fahrenheit.

(e) All metal work with the exception of the frame shall be covered with such non-heat-conducting substances on the stage side.

(f) The curtain shall operate vertically in steel guides of such a cross section that the edges shall engage and secure the edges of the curtain and prevent the curtain from leaving the guiding channel or channels if the curtain should tend to buckle or bag either inward or outward. No metal in the guide channel or in the engaging edge of the curtain shall be less than three-eighths of an inch thick. The joints of the curtain with the proscenium wall, with the stage floor and with the head of the opening shall be made gas tight as nearly as practicable.

(g) The calculations for the strength of the curtain, the curtain guides and the guide anchors, and the workmanship, shall be according to the best modern engineering practice. The stresses in the material and in the various sections of steel shall be within the safe limits of stress described in this ordinance.

(h) No part of a curtain or of the curtain guides shall be supported by or fastened by any combustible material.

(i) The supports of the curtain and the curtain guides and edges and the curtain shall be of sufficient strength to safely resist either inward or outward a pressure of five pounds for each and every square foot of the curtain.

(j) No combustible material other than painted decorations shall be applied to the audience side of any such curtain.

(k) Plans for every such curtain shall be approved by the Commissioner of Buildings and a permit obtained therefor previous to its erection. The Commissioner of Buildings shall inspect such curtain semi-annually, and for each such inspection a fee of five dollars shall be charged.

(l) Every other opening in such proscenium wall shall have self-closing regulation standard iron fire doors and iron frames and thresholds; such doors and frames shall be built in such a manner as to resist warping.

413. **Stage, Construction of—Fireproof Paint—Scenery—How Treated.)** (a) The framing of the floor of every stage shall be of iron or steel or fireproof material. The stage floor may be of wood not less than two and three-fourths inches thick. The entire floor construction and fly galleries, rigging lofts and paint galleries, all stairways and supports and stanchions therein and all sheaves, pulleys, cables and other supports shall be of iron or steel. The woodwork of the stage floor shall be saturated with a fireproof solution satisfactory to the Fire Marshal. All other woodwork and all framing for scenery on or about the stage shall be coated with fireproof paint, which shall be submitted to and approved by the Fire Marshal. All wood used for the floor supports shall be saturated with a fireproof solution satisfactory to the Fire Marshal.

(b) Counter weighting of scenery must be done with incombustible weights carried on steel cables and operated in grooves or slotted channels; except that small sand bags weighing not over eight pounds may be used to bring scenery ropes down to stage level.

(c) No scenery or stage paraphernalia of any sort shall be used upon the stage of any room used for the purposes of Class V unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal. All draperies in the auditorium, including the drop curtains, must be fireproofed at least once a year, subject to the approval of the Fire Marshal.

414. **Vestibules for Stage Doors.)** All doorways and openings in the rear or sides of the stage shall be vestibuled or arranged in a manner satisfactory to the Commissioner of Buildings, so as to protect the curtain, scenery and auditorium against draughts of air.

415. **Structures Over Ceiling—Construction.)** If any structure is built over the ceiling or roof of any theater, the different members of the girders or trusses supporting same shall be fireproofed in the manner prescribed for columns of fireproof buildings as specified in the General Provisions of this chapter.

416. **Vents—Size of—Flue Pipes—Dampers—Switches for Dampers.)** (a) One or more vents or flue pipes of metal construction, or other incombustible material, suitable for carrying away smoke, and approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof, and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

(b) In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional story.

(c) All such flues or vents shall be provided with metal dampers which shall be controlled or operated by a small tarred hempen cord and also by two electric switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the stage fireman's station on the opposite side of the stage; the arrangement of said cord and said electric switches shall be such that the cord will operate as a fusible link between the electric control and the damper and will release said damper, should the switches or either of them, fail to operate. Such stations shall be located in such places on the stage as may be determined by the Fire Marshal, subject to the provisions of this paragraph, and each switch shall have a sign with plain directions as to the operation of the same printed thereon.

(d) All fuse boxes shall be surrounded by two thicknesses of fireproof materials, with an air space between, and no fuses shall be exposed to the air between the switchboards.

417. **Automatic Sprinkler — Location — Tank—Connections.)** (a) An approved system of automatic sprinklers shall be provided in theatres of this class, which shall comply with the following requirements: (1st) Said sprinkler heads shall be placed in the paint room, store room, property room, scene storage room, carpenter shop, and dressing rooms and spaced according to the best fire protection practice; (2nd) Said system shall be supplied by a frost-protected gravity tank of not less than 5,000 gallons capacity located above stage roof and bottom of tank shall be not less than twenty-five feet above the highest sprinkler head, or by an automatic centrifugal pump of not less than 500 gallons capacity per minute against 100 pounds pressure at the pump; (3rd) Said gravity tank, if used, shall be entirely independent of any standpipe system, unless the tank is of sufficient capacity to supply both systems and unless the supply pipe to standpipe is so arranged that it can not reduce the sprinkler system supply; (4th) Said gravity tank, if used, shall be filled through a supply pipe at least one and one-half inches in diameter from fire pump hereinafter provided for in this chapter; (5th) There shall be a pipe of not less than three-inch diameter connected to the sprinkler system and extending to the outside of the building with a Siamese steamer connection properly placarded and suitable for Fire Department use, (6th) There shall be an approved system of local alarms with a bell in the ticket office, a buzzer in the lobby and on the stage and a bell and annunciator in the basement or in the boiler or engine room; all necessary gauges, including altitude gauge for tank riser, shall be located on main floor. Swing checks and gates shall be provided.

(b) The entire sprinkler system and equipment and the location, installations and maintenance thereof, shall be subject to the approval of the Fire Marshal.

418. **Fire Apparatus on Stage—Hand Fire Pumps—Fire Apparatus.)** There shall be installed on each side of the stage a standpipe of not less than three inches in diameter with a hose connection at the stage floor and at each floor level above and below the stage, which standpipe shall be supplied by a frost-protected gravity tank of a capacity of not less than 5,000 gallons. The bottom of said gravity tank shall be

elevated at least twenty-five feet above the highest hose outlet and said gravity tank shall be equipped with a centrifugal power pump with hand controller, which power pump shall have a pumping capacity of not less than three hundred gallons per minute against fifty pounds pressure at the stage roof, except in cases where an automatic pump is installed which shall comply with the provisions of Section 417 of this chapter, in which event such pump may be used as a source of supply for standpipes. In addition to the above requirements of this Section there shall be a pipe of not less than three inches in diameter connected to the standpipes and extending to the outside of the building and equipped with a Siamese steamer connection properly placarded for and suitable for fire department use. All gravity tanks shall be filled through not less than one and one-half inch connection from pump and shall be provided with gauges, swing checks and gate valves. Each standpipe shall have one and one-half-inch hose outlet above, below and on the stage. Such outlet shall be provided with a straightway hose and a valve and drop cock connection. A length of approved one and one-half-inch unlined linen hose shall be attached to each outlet, which said linen hose shall have a five-eighths of an inch smooth bore nozzle. All hose shall be mounted on self-releasing racks when not in use. The entire equipment shall be installed under the direction of and subject to the approval of the Fire Marshal. Portable fire extinguishers or hand fire pumps shall be kept ready for use on and under the stage and in the flies, galleries and rigging loft. There shall be kept for use in every theatre of this class at least four fire department axes and six pike poles on each tier or floor of the stage, all of which shall be subject to the approval of the Fire Marshal.

419. **Hot Air Furnaces.)** The use of ordinary hot air furnaces or stoves in all theatres of Class V is prohibited.

420. **Independent Lighting System for Exits—Red Light Over Exits.)** All stairways and corridors shall be supplied with a supplementary lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building. The word "EXIT" shall appear in letters at least six inches high over the opening to every means of egress from such theatre and a red light furnished by gas or sperm oil, shall be provided over such sign.

421. **Fire Alarm Apparatus.)** Every theatre shall be provided with an approved system of automatic or manual fire alarm telegraph apparatus, connected by the necessary wires with the headquarters of the city fire alarm telegraph and such other place or places as the Fire Marshal shall direct. The number and location of the boxes and the character of the system, whether automatic or manual, or both, shall be determined by the Fire Marshal.

422. **Dressing Room Partitions.)** Partitions forming dressing rooms shall be constructed of incombustible material, and such dressing rooms shall be properly ventilated.

423. **Capacity—Certificate for License.)** (a) The Commissioner of Buildings shall determine the number of persons which each room used for the purpose of Class V may accommodate according to the provisions of this chapter, and shall certify the same to the City Clerk. No more than the number so certified shall be allowed in such room at any one time.

(b) No license for the operation of a theatre shall be issued unless the Commissioner of Buildings, Fire Marshal and City Electrician shall first have certified in writing that such theatre complies with the provisions of this chapter in every respect.

424. **Lighting Equipment.)** Every room used for the purposes of Class V, and all outlets therefrom leading to the streets, including passageways, courts, corridors, stairways, exits, and emergency stairways, shall have gas or electric lighting equipment to properly illuminate such room and spaces, and every passageway, court, corridor, stairway, exit, and emergency stairway, shall be provided with signs, indicating the way out of the building, the letters of which shall not be less than six inches in height.

425. **Lights—Control of Lights in Halls, Corridors and Lobbies—Separate Shutoff—Connections with Gas Mains—Independent Connections—Protection of Suspended and Bracket Lights—Protection of Lights Inserted in Walls—Protection of Footlights—Construction of Border Lights—Ducts and Shafts Conducting Heated Air from Lights—Gas Stage Lights to Have Metal Screens.)** Gas and electric lights in the halls, corridors, lobbies or any other part of any theatre used by the audience, except the auditorium, shall be controlled by a separate shutoff located in the lobby and controlled only in that particular place. Gas mains supplying such theatre shall have independent connections for the auditorium and the stage, and provision shall be made for shutting off the gas from the outside of the building. Suspended or bracket lights surrounded by glass in the auditorium, or in any other part of the theatre shall be provided with proper wire netting underneath. No gas or electric lights shall be inserted in the walls, woodwork, ceiling, or in any part of the theatre unless protected by fireproof materials. The trough containing footlights shall be formed of and surrounded by fireproof material. Border lights shall be constructed according to the best known methods, and subject to the approval of the Fire Marshal and the City Electrician, and shall be suspended by wire ropes. Ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double, with an air space between. Gas stage lights shall have strong wire metal guards or screens, not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of the flames of such lights, and shall be soldered to the fixtures in all cases.

426. **Fire Apparatus to Be Under Control of Fire Department.)** The standpipes, automatic sprinklers, gas pipes, electric wires, hose, footlights, fire alarm boxes, fireproof proscenium curtains, switch boxes, ventilators, controlling levers, axes and pike poles, and all apparatus for the extinguishing of fire or guarding against same, as provided for by this ordinance, shall be made and kept at all times in condition satisfactory to and under control of the Fire Marshal.

427. **Scenery—Definition—Movable Scenery.)** (a) "Scenery" as used in this chapter shall include all scenery, drop curtains, borders and wings which are constructed or made of cloth, canvas or combustible material, whether stationary or movable.

(b) "Movable Scenery" shall include all scenery, drop curtains, borders, and wings which are made movable for the purpose of changing an entire set of scenery and substituting another set during or between the various stage acts.

428. **Communication Between Box Office, Stage and Fly Galleries.)** A system of telephonic communication, subject to the approval of the Commissioner of Buildings and the City Electrician shall be installed between the box office, both sides of the stage,

fly galleries, gridiron and space beneath the stage.

429. **Changing from Class IV to Class V.)** Whenever an existing Class IV theatre is changed into a Class V theatre, the same shall be made to comply with all of the provisions for Class V theatres hereafter erected.

ARTICLE IX.

Class VI.

430. **Class VI Defined.)** In Class VI shall be included every tenement and apartment house or building or portion thereof, which is used or intended to be used as a home or residence for two or more families living in separate apartments.

431. **Requirements—General.)** Every building of Class VI shall comply with the provisions of this chapter, and in addition to the general provisions shall comply with the following special provisions:

*432. **Definition of "New Tenement House" —"Apartment"—"Yard"—"Court" —"Shaft" "Public Hall"'—"Stair Hall"—"Basement" —"Cellar"—"Story"—"Solid Masonry".)** (a) "New tenement house" shall include every tenement, flat and apartment house hereafter erected and every tenement house which shall be increased or diminished in size or otherwise altered after its erection and every building now or hereafter in existence not now used as a tenement house but hereafter converted or altered to such use.

(b) "Apartment" is a room or suite of two or more rooms occupied or intended or designed to be occupied as a family domicile.

(c) "Yard" is an open unoccupied space on the same lot with a tenement house, separating every part of every building on the lot from the rear line of the lot.

(d) "Court" is an open, unoccupied, unobstructed space, other than a yard, on the same lot with a tenement house; a court entirely surrounded by a tenement house is an "inner court"; a court bounded on one side and both ends by a tenement house, and on the remaining side by a lot line is a "lot line court"; a court extending to a street, alley or yard is an "outer court."

(e) "Shaft" includes exterior and interior shafts, whether for air, light, elevator, dumb waiter or any other purpose; a "vent shaft" is one used solely to ventilate or light a water closet compartment, bath room, or pantry.

(f) "Public Hall" is a hall, corridor or passageway not within an apartment.

(g) "Stair Hall" includes the stairs, stair landings and those portions of the public halls through which it is necessary to pass in getting from the entrance floor to the top story.

(h) "Basement" is a story partly, but not more than one-half below the level of the inside sidewalk grade of the street nearest the building; if the floor of such basement is less than two feet below said grade, or if the ceiling of such basement is more than five feet above said grade, said story shall be classed as the first story of the building in which it occurs.

(i) "Cellar" is a story more than one-half below the level of the inside sidewalk grade of the street nearest the building.

Where the grade of a street adjacent to a tenement house varies, the average grade of such street opposite the lot containing the tenement house shall be regarded as the grade of such street within the meaning of this Chapter.

*Amended July 2, 1914.

(j) "Story" is that portion of a building between the top of any floor beams and the top of the floor or ceiling beams next above.

433. **Sections—Where Conflicting With Other Sections.)** In cases of direct conflict with the provisions of other sections of this ordinance relating to other classes, the provisions of the sections relating to Class VI shall govern in respect to tenement houses.

434. **Changes or Alterations—Permits.)** Every new tenement house and every change or alteration in any existing tenement house shall conform to the requirements of this chapter. No new tenement house shall be begun, nor shall any changes or alterations in any existing tenement house, such as are referred to in this chapter, be begun until a permit therefor shall have been issued by the Commissioner of Buildings. Such permit shall be issued only upon an application by the person, firm or corporation for whom the building is to be erected or altered, and after approval of the plans and specifications for such tenement house or for such changes or alterations by the Commissioner of Health whenever such approval is required by the ordinances of the City of Chicago.

435. **New Tenement House—When to be Occupied.)** (a) No new tenement house shall be occupied in whole or in part for human habitation until the issuance of a certificate by the Commissioner of Health that said building conforms to the requirements of this chapter relative to light and ventilation, plumbing and drainage applicable to said buildings, nor until the issuance by the Commissioner of Buildings of a certificate that the said building conforms to the requirements of this chapter relative to fire escapes and means of egress applicable to new tenement houses. Within five days from date of application for any certificate above mentioned, such certificate shall be issued or the official concerned shall state in writing his reasons for his refusal to issue said certificate.

(b) The certificate above referred to may be issued in the case of a new tenement building comprising more than three apartments so as to allow the occupation of any section of the building extending from cellar to roof in advance of the completion of the other portions of the building.

(c) When the outer walls of a new tenement house have been erected so as to outline the position of the courts and shafts required for the lighting and ventilation of habitable rooms, the owner of the building or his representatives shall be entitled, upon application in writing, to an inspection of the same by the Commissioner of Buildings, and if the work to that point is in compliance with the provisions regarding the size of shafts and the location of the building, to a certificate setting forth those facts.

(d) When the work of constructing partitions has advanced to a degree on any floor, that the rooms on that floor are determined in their dimensions, the owner or his representatives shall be entitled to an inspection from the Commissioner of Buildings, and if the rooms thus outlined conform in their dimensions to the plans filed and to the requirements of this chapter, to a certificate stating that fact.

(e) If a new tenement house is occupied as a place of habitation in any of its parts in violation of this section, it shall forthwith be subject to notice from the Commissioner of Buildings and shall be vacated upon such notice and shall not again be occupied until made to conform with the provisions of this chapter nor until after the issuance of the two certificates required in this section.

436. **Plat to be Filed.)** At the time of applying for a permit for the erection of, alteration of, addition to or moving of a tenement house or for the erection, alteration, adding to or moving of any building upon a lot upon which a tenement house stands, the applicant shall submit to the Commissioner of Buildings a plat of the lot, showing the dimensions of the same and the position to be occupied by the proposed building or by the building to be altered or added to or by

the building to be moved thereon, and the position of any other building or buildings that may be on the lot. The measurements shall in all cases be taken at the top of the first story and shall not include any portion of any street or alley.

437. **Corner Lot Defined—Frontages.)** By "corner lot" is meant a lot situated at the junction of two streets or of a street and a public alley at least sixteen feet wide, provided that if such alley be less than sixteen feet wide, and the lot be estimated on a line sixteen feet from the opposite side of the alley, such lot may be considered a corner lot. Any portion of the width of such lot distant more than fifty feet from such junction shall not be regarded as part of a corner lot, but shall be subject to the provisions of this chapter respecting other than corner lots. Where, in corner lots, the two frontages are of unequal length, the lesser street frontage shall be taken as the width of the lot. Street frontage alone, and not alley frontage shall be considered in determining such lesser frontage.

438. **Height—How Measured.)** (a) The height of a new tenement house shall not exceed by more than one-half the platted width of the widest street on which it abuts, and no existing tenement house shall be increased beyond such height.

(b) Provided, however, that any distance the building sets back from the lot line shall be added to the width of the street in making this computation. Such height shall be the perpendicular distance from the grade nearest the house to the highest point of the roof but shall not include as part of the roof any cornice or bulkhead less than eight feet high, or any elevator enclosure less than sixteen feet high. Where such street grade varies, the mean or average grade thereof opposite such house shall be the datum from which such height shall be measured.

*439. **Distance Between Buildings.)** No existing tenement house shall hereafter be enlarged or its lot be diminished, so that the rear line of any building on such lot approaches nearer than ten feet to the rear line of the lot, unless the rear of the lot upon which it stands, abuts upon a public alley, in which case the rear line of such building shall be not less than sixteen feet from the opposite side of such alley. Where a tenement house, now existing or hereafter erected, stands upon a lot other than a corner lot, no other building shall hereafter be placed upon the front or rear of that lot, unless the minimum distance between such buildings be at least ten feet, if neither building exceeds the height of one story; or fifteen feet, if either building exceeds the height of one story, but not the height of two stories, and so on, five additional feet to be added to such minimum distance of ten feet for every story more than one, in the height of the highest building on such lot: *Provided, that a one-story building without basement, and not used for habitation, may be placed on the rear of a lot containing a tenement house, if a minimum distance of ten feet is maintained between every point of such building and the tenement house.*

*Amended March 18, 1913.

440. **Percentage of Area Allowed to be Covered.)** No existing tenement house shall hereafter be enlarged nor its lot be diminished, nor other buildings be placed on its lot, nor a tenement house be moved on a lot on which there is an existing building, so that after such change a larger proportion of any corner lot or other lot upon which it is situated is covered by buildings, than the following proportions, respectively: No new tenement house alone or with other buildings now or hereafter erected, shall occupy above the first story more than eighty-five per centum of the area of a corner lot, provided that in the case of a fireproof building, in which the windows of every habitable room open directly on a street, the portion of the lot covered may be ninety per centum of the area of said lot, subject to the requirement that a ten foot space must be left above the first story opposite the lesser frontage; or more than ninety per centum of the area of such corner lot if such corner lot is bounded on at least three sides by streets or alleys; or more than seventy-five per centum of the area of any other lot, provided that the space occupied by fire escapes, constructed and erected according to law and not more than four feet wide, shall be deemed unoccupied. Provided, however, that in case of a lot, triangular or irregular in shape bounded on two or more sides by a street and having a number of lineal feet street frontage exceeding one-twentieth of the number of square feet in the area of such lot, it shall not be necessary to comply with the conditions of this section as to percentage of lot which may be covered.

441. **Must Have Alley or Yard in Rear—Size of Yard Increased.)** At the rear of every lot containing a tenement house, there shall be a yard open and unobstructed from the earth to the sky, except by fire escapes not more than four feet wide, constructed and erected according to law, unless the rear of such lot abuts upon a public alley at least ten feet wide, in which case the rear line of such building shall be not less than 16 feet from the opposite side of such alley; every part of such yard shall be directly accessible from every other part thereof; such yard shall have an area of at least eight per centum of the superficial area of the lot on corner lots except as otherwise provided in this section; and on other lots, such yards shall have an area of at least ten per centum of the superficial area of the lot. Every such yard shall be increased one per centum of the superficial area of the lot for every story above three stories in height of the tenement house situated thereon.

*442. **Courts—Inner—Outer—Lot Line.)** (a) "Inner courts" of all new tenement houses as defined in Section 432 of this ordinance, shall have minimum widths at every point and minimum areas as follows:

Courts—Height of	Least width in feet.	Least area in square feet.
1 story	6	100
2 stories	6	120
3 stories	8	160
4 stories	8	160
5 stories	12	260
6 stories	16	400
7 stories	20	625
8 stories or more.	24	840

(b) The height of a court shall be the number of stories having habitable rooms with windows in its walls.

(c) "Outer courts" and "lot line courts" of all new tenement houses as defined in Section 432 of this chapter shall have minimum widths at every point equal to one-half of the minimum widths required by this section, and lot line courts shall have minimum areas equal to one-half of the minimum areas required herein for "inner courts." *If an outer court or lot line court has windows on opposite sides, its minimum width shall conform to the width given in the table.*

*Amended October 15, 1913.

(d) The minimum widths hereinbefore specified for outer courts and the minimum widths and areas specified for lot line courts are to be provided irrespective of the presence of or dimensions of courts on other premises bounded by the same lot line.

(e) Every "inner court" and every "lot line court" of every new tenement shall be

connected directly with a street, alley, yard, or outer court by an opening extending from grade at the building to a height of at least fifteen feet, and kept unobstructed save by an openwork grill or gate, such opening to be at least two feet wide for an inner court and one foot wide for a lot line court. In case of a three-story tenement on a lot twenty-five feet or less in width, a continuous lot line passage open to the sky, and six inches in width, shall be accepted for the opening specified above as one foot wide for a lot line court. If such inner court or lot line court starts from any point above finished grade at building, such starting point shall be considered as grade for purpose of determining the location of the opening to outer air herein specified.

(f) In case of a three-story tenement on a lot twenty-five feet or less in width a continuous lot line passage open to the sky, and at least three feet wide, shall be accepted in lieu of a lot line court or outer court hereinbefore specified in Paragraph (a). In case of a three-story tenement on a lot thirty feet or less in width, a continuous lot line passage open to the sky, and at least three feet six inches wide shall be accepted in lieu of a lot line court or outer court hereinbefore specified in Paragraph (a).

*Amended March 20, 1911.

(g) In case of a two-story tenement on a lot twenty-five feet or less in width, a lot line court having an area of at least fifty square feet shall be accepted in lieu of a lot line court heretofore specified in Paragraph (a) of this section, and in case of a three-story tenement on a lot of twenty-five feet or less in width, a lot line court having an area of at least sixty square feet shall be accepted in lieu of a lot line court hereinbefore specified and required by Paragraph (a) of this section.

(h) In case of two or three-story tenement buildings on lots twenty-five feet or less in width, where there is only one apartment on each story containing not more than four rooms in such apartment, the light courts hereinbefore specified in Paragraph (a) may be omitted, provided there is a continuous passageway open to the sky and not less than three feet wide on one side of said building.

443. **Vent Shaft—Area Of.)** (a) "Vent shafts" of all new tenement houses, as defined in Section 454 of this ordinance, shall have minimum widths at every point and minimum areas as follows:

Vent shafts Height of	Least width in feet	Least area in square feet.
1 story	3	21
2 stories	3	22½
3 stories	3	27
4 stories	3	36
5 stories	5	48
6 stories	6	72
7 stories	8	96
8 stories or more.	8	120

(b) Every such vent shaft in every new tenement house more than two stories high, shall be connected directly with a street, alley, yard or court by one or more horizontal ducts or intakes at a level not lower than the finished grade of building nor higher than second story floor; the total area of such ducts to be not less than three per cent of the area of such vent shaft, and no single duct to be of less area than one hundred square inches; such total and individual duct area shall be net over and above all obstructions.

444. **Stair Hall and Shaft—Well-Hole Dimensions.)** (a) Every public stair hall in every new tenement house shall, for each story, have a window of an area of at least twelve square feet, opening directly on a street, alley, yard or court; or on a shaft of minimum area, as hereinafter provided; or shall have an unobstructed vertical well-hole of the following minimum area at each floor line above the first, and, directly over such well-hole, there shall be a skylight of twice the following minimum area:

Building— Height of	Least area in square feet of stair shaft or well hole.
2 stories—if there is more than one apartment on a floor	8
3 stories—if there is more than one apartment on a floor	13
4 stories	19
5 stories	25
6 stories or more	38

(b) Such window, if any, shall be so placed that light may pass directly to the opposite end of the hall, or else there shall be at least one window opening directly upon a street, alley, yard or court in every twenty feet in length or fraction thereof of such hall, except in so much of any entrance hall as lies between the entrance and the flight of stairs nearest the entrance, in any such public hall, recesses or returns, the length of which does not exceed twice the width of the hall, will be permitted, without an additional window, but, otherwise, each recess or return shall be regarded for the purposes of this section as if it were a separate hall. Any part of a public hall which is shut off from any other part by a door or doors shall be deemed a separate public hall within the meaning of this section.

(c) Skylights shall be ventilating skylights and shall have over them a wire netting mounted on wire frame and 6-inch iron legs, of wire not lighter than No. 12 and with mesh not coarser than one inch by one inch, unless constructed of wired glass or prismatic light glass.

445. **Rooms—Sizes and Height Of—Attic Rooms.)** (a) In every new tenement house, all habitable rooms shall be of the following minimum sizes:

(b) In each apartment, there shall be at least one room containing not less than one hundred twenty square feet of floor area, and every other room shall contain at least eighty square feet of floor area, provided, however, that in the case of a room having a window not less than eighteen feet in area opening upon a public street, the floor area need not be greater than seventy feet. Each room shall be in every part not less than eight feet six inches high from the finished floor to the finished ceiling; provided, however, an attic room need be eight feet six inches high in but one-half of its area, provided there are not less than 750 cubic feet of air space therein.

446. **Alcoves and Alcove Rooms.)** (a) For the purpose of buildings of Classes III and IV, an alcove shall be defined as a recess connected with or at the side of a larger room. The floor of such an alcove shall be counted as a part of the floor area and its cubic contents as a part of the cubic contents of the room with which it is connected.

(b) In every new tenement house every alcove shall be deemed a separate room for all purposes within the meaning of this chapter, except an alcove that has a floor area of not to exceed thirty-five square feet and that has an unobstructed opening, equal in area to twenty per centum of its entire wall surface, into an adjoining habitable room; provided that in constructing additional habitable rooms by raising or altering existing one story dwellings, the limitation of the floor area of an alcove may be disregarded, provided such alcove has an unobstructed opening, equal to the floor area of such alcove, into an adjoining habitable room.

(c) This section shall not be construed as forbidding the erection of pilasters or other decorative effects projecting not more than eighteen inches from the plane of the wall of a habitable room.

(d) No part of any room in a tenement house shall be enclosed or sub-divided at any time, wholly or in part, by a curtain, portiere, fixed or movable partition or other contrivances or device, unless each part of the room so enclosed or sub-divided shall contain a separate window as herein required, and shall have a floor area of not less than 80 square feet as hercin required for habitable rooms, except as heretofore provided in this section.

447. **Air—Quantity of for Each Person.)** No room in any tenement house shall be occupied so that the allowance of air to each adult person living or sleeping in such room shall at any time be less than four hundred cubic feet or less than two hundred cubic feet for each person under twelve years of age.

448. **Habitable Rooms—Bath Rooms—Pantries—Requirement as to Ventilation and Lighting.)** (a) In every new tenement house every habitable room shall have a window or windows with a total glass area opening onto a street, alley, yard or court. None of such required windows shall have a glass area of less than ten square feet, and each such window shall have its top not less than seven feet above the floor and shall be so constructed that at least its upper half may be opened its full width.

(b) In every new tenement house every bath room, water closet, or urinal compartment shall have at least one window with a glass area of at least six square feet and a minimum width of one foot, opening upon a street, alley, yard, court or vent shaft.

(c) In every new tenement house every pantry shall have at least one window of not less than six square feet in area, with a width of not less than one foot, opening into a street, alley, yard, court or vent shaft, which vent shaft shall be at least six square feet in area.

449. **New Tenements—Habitable Rooms in Basements—Prohibited in Cellars.)** In no new tenement house shall any room in the cellar be constructed, altered, converted or occupied for living purposes; and no room in the basement of a new tenement house shall be constructed, altered, converted or occupied for living purposes unless such rooms shall be at least eight feet six inches high in the clear and shall have at least one-half of such height above the finished grade of said premises at the building, and at least four feet three inches of such height above the average street grade at the building.

450. **Tenement Houses—Requirements for Fireprcof and Slow-burning Construction.)** Every new tenement house more than five stories and basement high shall be of fireproof construction. Every new tenement house more than three stories and basement high, but not more than five stories and basement high shall be of slow-burning or fireproof construction. In case slow-burning construction be required, the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction.

*451. **Frame Tenement—Requirements.)** *In every new frame tenement house outside the fire limits, each suite of apartments shall be separated from the next suite in such building by a partition of four-inch tile or of metal studding and metal lath, and the enclosing walls around the stairs, where there are two or more apartments on a floor, shall be of fireproof construction or of solid masonry of the same dimensions as are required by Section 519.*

*Amended February 20, 1911.

*452. **Frame Additions to Frame Tenement Houses Within Fire Limits Not Permitted—Removal of Frame Tenement Houses.)** No frame addition shall be permitted to any frame tenement house within the fire limits, either by adding to its height or its superficial area.

If a tenement house, standing on wooden supports, is moved to another lot, it shall not again be placed on wooden supports, but shall be placed on a masonry or concrete foundation.

If a frame tenement house, not more than two stories high, is moved from one location to another upon the same lot, it may be set upon wooden posts and a basement or cellar not to exceed six feet six inches in height from the floor to the ceiling thereof may be maintained thereunder, and no habitable rooms shall be constructed or occupied in said basement or cellar.

*Amended July 8, 1912.

453. **Entrance Halls—Solid Masonry—Exceptions—Ceilings.)** Every main entrance hall in a new tenement house shall be at least three feet six inches wide in the clear from the entrance up to and including the stair enclosure and beyond this point at least three feet wide in the clear. In every new non-fireproof tenement house, except where there be only one apartment on each floor, such entrance hall shall be inclosed with solid masonry walls and with ceilings covered with incombustible material and shall comply with all the conditions of the following sections of this ordinance as to the construction of stair halls. If such main entrance is the only entrance to more than one flight of stairs, the several portions of such main entrance hall which separate the entrance of the building from the several flights of stairs, respectively, shall be increased respectively at least one foot in width for each additional flight of stairs.

454. **Stair Halls—Construction Of.)** (a) The stairs and stair halls in all new tenement houses more than three stories and basement or cellar high shall be constructed of incombustible material throughout, except that the treads of stairs may be of wood not less than one and three-eighths inches thick and all handrails may be of hardwood.

(b) In every new non-fireproof tenement house all stair halls shall be enclosed on all sides with walls of solid masonry of the dimensions required by Section 519. All windows in stair halls, except where same open into a street, alley, outer court, or yard, shall have metal frames and sashes, glazed with wired glass. This section shall not apply to tenement houses which are not more than three stories and basement high with only one apartment on each floor.

*455. **Apartments Divided by Masonry.)** *(a) There shall be a wall of solid masonry of thickness as required by Section 519, extending from the ground to the roof between each set of apartments and around each court and each light shaft, except as hereinafter provided; (a) provided, however, that a wall between apartments and extending from the main stair hall to the outer wall of the building may be offset at the second story floor line to some point nearer the center of the building, or of the group of apartments, to admit of an even distribution of space in the rooms adjacent to such wall, if such wall is supported at the second story floor line on fireproofed steel or iron beams which extend from the brick wall surrounding the main stair hall to the outer wall of the building; and provided, further, that such offset wall may be reduced to the thickness of eight inches, if supported at each floor line above the first story on fireproofed steel or iron beams carried by masonry walls as above specified; (b) and provided, however, that, in case there is a store or stores in the first story of a building of this class, a masonry dividing wall between apartments may begin at the second story floor line, if such dividing wall is supported on fireproofed steel or iron beams carried by masonry; and provided, further,*

that such dividing wall may be reduced to the thickness of eight inches, if supported at each floor line above the first story on fireproofed steel or iron beams carried by masonry. And provided that in buildings of fireproof construction the partitions between apartments, and around stairs may be of burnt clay tile not less than three inches in thickness or re-inforced concrete partitions not less than three inches in thickness.

(b) In buildings of ordinary construction two separate thicknesses of metal lath and fire-resisting plaster shall be used as fireproofing as required by this section.

*Amended February 20, 1911.

456. **Ceilings Over Stores—Courts and Shafts Beginning Above First Story.)** (a) In every new non-fireproof tenement house in which there is a store or stores in the first story, if the building is three stories or less in height, the portions of the first story ceiling directly under all public halls shall be of slow-burning construction, and if the building is four or more stories in height the entire basement and first story construction and the second story floor construction shall be of fireproof construction.

(b) In every new non-fireproof tenement house the masonry walls enclosing every court or light or vent shaft beginning above the first story shall be supported on fireproofed steel or iron beams carried by masonry or by fireproofed steel or iron columns; and such court or shaft enclosing walls may be reduced to the thickness of eight inches if supported at every intersecting floor line on fireproofed steel or iron beams carried as above specified.

457. **Damp-Proofing—Basement Walls to Be Masonry—Cement Floor.)** In every new tenement house constructed of brick or frame, the foundations and basement walls shall be built of masonry or concrete not less than twelve inches in thickness, except as provided in Section 519 and shall have all outside walls below the adjacent ground level plastered on the outside with Portland cement or treated with other approved damp-proofing material, and such walls, as high as the ground level, shall be laid in cement mortar. The basement or cellar of every existing and new tenement house shall have a floor of Portland cement concrete not less than three inches in thickness laid on not less than six inches of sand or cinders.

*458. **Bay Windows—Courts—Vent Shafts.)** (a) The walls of every bay window and every court in masonry constructed new tenement houses shall be built of brick or other fireproof construction as required for exterior walls.

(b) The walls of every interior vent shaft in masonry constructed tenement houses shall be built of masonry or of fireproof material not less than four inches in thickness, supported by steel or iron.

*Amended February 20, 1911.

*459. **Porches.)** (a) Where porches are constructed in courts of now existing or new tenement houses, the amount of area of unobstructed space in such courts shall be exclusive of space occupied by stairs and porches. No additional rear porch shall be constructed on any existing tenement house in such way that the buildings on the lot with all their porches shall occupy a greater proportion of the lot than is permitted in Section 440 of this chapter. No rear porch on any existing tenement house where the total area of buildings and all porches exceeds the proportion of the lot permitted in Section 440 of this chapter shall be reconstructed until the plan for such re-construction shall have been submitted to and approved by the Commissioner of Buildings. No rear porch built of combustible materials and more than eight feet in width, excepting stairways, shall be constructed on any new tenement house nor added to, nor reconstructed on any existing tenement house.

(b) Front porches of buildings in existence at the time of the passage of this amendatory ordinance may be enclosed temporarily from the first day of November in each year to the first day of the following May with wood sash glazed with ordinary glass; provided that the glass area shall be as large as is consistent with good construction and the ordinances of the city; and further provided, that the sashes are fitted with hinges or hung in such a manner as to allow them to open at least one-half of their area, or that one-half of all the sash installed are so fitted or hung as to open their entire area, and the area of such open sash shall be at least twice the area of all windows from adjacent rooms opening on to porches so enclosed, unless such room adjoining said porch shall have windows opening on to a street, alley, yard or court of proper legal dimensions as required by this Chapter for habitable rooms in addition to the windows opening on to the porch, in which case the amount of movable sash in porch enclosure shall be not less than ten per cent of the floor area of said porch and in no case less than ten square feet of glass area.

(c) Rear porches and side porches of buildings in existence at the time of the passage of this amendatory ordinance, where every part of said porch is at least ten feet distant from any other building, porch or structure located upon the same lot with the building of which such porch is a part, may be enclosed temporarily from the first day of November in each year to the first day of the following May with wood sash glazed with ordinary glass; provided, that the glass area of the enclosure shall be as large as is consistent with good construction and the ordinances of the city; and further provided, that the sashes are fitted with hinges or hung in such a manner as to allow them to open at least one-half their area, or that one-half of all the sash installed are so fitted or hung as to open their entire area, and in no case shall be less than three times the area of all windows, doors and transoms opening on to said porch, and that in every case the top of the sash in such enclosure shall be at least six inches higher than the top of the windows and doors opening on to such porch. The framing of the porch enclosure may be of wood, and the glass area of each side and of each end of such porch shall be not less than fifty per cent of the entire side or end of such porch enclosure measured from the floor of the porch to the under side of joists immediately above such porch in each story.

(d) In every building erected after the passage of this amendatory ordinance, every front porch, rear porch or side porch which is intended to be enclosed must have enclosing walls as required by the ordinances of the city for enclosing walls of a building of the type of which said porch is a part, and every porch so enclosed shall be considered a separate habitable room and shall comply with all the requirements of this Chapter for habitable rooms, and such porch enclosure shall not in any manner intercept the light or the ventilation of any adjoining room.

*Amended March 2, 1914.

*460. **Flues and Chimneys.)** *In every building used for the purposes of Class VI, the flues or chimneys shall conform to the following regulations: For one stove opening, the flue area shall not be less than forty-nine square inches. For more than one stove opening and one furnace opening, the flue area shall not be less than seventy-seven square inches. All such flues shall be constructed according to the requirements of Section 584 of this chapter.*

*Amended February 20, 1911.

461. **Bulkhead in Roof—Construction of —When Required.)** There shall be in the roof of every new tenement house, unless the pitch of the roof thereof exceeds one foot rise in four foot run, at least one bulkhead or scuttle, fireproof or covered with fireproof material, with stairs or ladder leading thereto; no such roof opening shall be less than two feet by three feet. Where such tenement house is provided with rear stairs, there shall be a bulkhead or scuttle

accessible from each of such rear stairs. No scuttle or bulkhead door shall have any lock on it but may be fastened on the inside by movable bolts or hooks.

*462. **Stairways—Width and Construction of.)** *(a) Every now existing and every new tenement house shall have at least two flights of stairs, which shall extend from the entrance floor to the top story, and which stairs, shall be as far apart as practicable. One of said stairways shall be an interior stairway. Such stairs and the public halls in every tenement house shall each be at least three feet wide in the clear, and every apartment shall be directly accessible from both such flights of stairs without going through any other apartment. In a fireproof building, where a public corridor serving two or more apartments, leads directly to a stairway, such corridor and stairway will be credited as one of the two required stairways. If any existing tenement house be so altered as to increase the number of apartments therein, or if such building be increased in height, or if the halls and stairs therein be damaged by fire or otherwise to an extent greater than one-half the value thereof, the entrance, stair halls, entrance halls and other public halls of the building so damaged shall be made to conform to the requirements of this Chapter relating to new tenement houses.*

*Amended February 20, 1911.

(b) All enclosed stairs in every tenement house shall have at least one handrail, and where the width of such stairs is greater than 3 feet 6 inches, such stairs shall have a handrail on each side thereof. All open stairs shall be provided with suitable and substantial handrails on each side.

463. **Stairs in Non-Fireproof Buildings, Eighty or More Rooms.)** Every new non-fireproof tenement house containing over eighty rooms, exclusive of bath rooms, shall have one additional flight of stairs, over and above the flights hereinbefore provided for, for every additional eighty rooms, or fraction thereof; but if such building contains not more than one hundred and twenty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building shall be at least one-half wider than is provided in this chapter.

464. **Stairs in Fireproof Buildings, One Hundred and Twenty Rooms and Upward.)** Every new fireproof tenement house containing over one hundred and twenty rooms, exclusive of bath rooms, shall have one additional flight of stairs, over and above the flights hereinbefore provided for, for every additional one hundred and twenty rooms or fraction thereof; but if such building contains not more than one hundred and eighty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building may be made at least one-half wider than is provided in this chapter.

465. **Stairs — Entrance to — Treads and Risers.)** Every flight of stairs required in a tenement house shall have an entrance on the entrance floor from a street or alley, or from a yard or court which opens into a street or alley. All stairs except rear stairs, in new tenement houses, shall have risers not more than seven and three-quarters inches high and treads not less than nine and one-half inches wide exclusive of nosings, except in winding stairs, where all treads at a point eighteen inches from the strings on the well side shall be at least nine and one-half inches wide, exclusive of nosings.

466. **Fire Escapes.)** Every tenement house four or more stories in height shall be provided with a fire escape or fire escapes, such as are required by this chapter. In every case each separate apartment shall have direct access to at least one such fire escape unless such apartment shall have direct access, without passing through any other apartment, to at least two separate flights of stairs leading to the ground, one of which is placed in front and one in the rear of such building, and one of which may be placed outside of the building; but where such separate apartment shall not have access to two such flights of stairs, then such apartment shall have direct access to a stairway fire escape. Every court in which there is a fire escape shall have direct and unobstructed access along the surface of the ground to a street or alley or to yard opening into an alley or street without entering into or passing through or over any building unless by a four foot wide fireproof passage on the court or ground level. Except as herein specifically provided, the number, location, material and construction of fire escapes shall be controlled by the general provisions of this chapter on fire escapes.

467. **Stairways and Fire Escapes to Be Free From Obstruction.)** No obstruction of any kind shall at any time be placed before, upon or against any stairway, steps or landings or fire escapes in or upon any tenement house. All fire escapes upon tenement houses shall be kept in good order and repair, and every exposed part thereof shall at all times be protected against rust by durable paint.

468. **Shafts, Courts, Yards, Graded—Concrete—Drained.)** In every now existing and new tenement house, the bottom of all shafts, courts or yards shall be provided with sanitary drainage and shall be graded or paved.

469. **Access to Rooms—Otherwise than Through Bedroom.)** In each apartment in every new tenement house, access to every living room and bedroom, and to at least one water closet compartment shall be had without passing through any bedroom.

470. **Water Closets—Windows in—Artificial Light.)** (a) In every new tenement house there shall be a separate water closet in a separate compartment within each apartment, except that where there are apartments consisting of only one or two rooms, in which case there shall be at least one water closet for every two apartments.

(b) Every water closet compartment in every existing tenement house shall be ventilated by such a window, or else by a vent shaft of at least one-half the minimum area required in Section 443. Every water closet compartment in every tenement house shall be provided with proper means of artificially lighting the same. If fixtures for gas or electricity are not provided in any such compartment, then the door thereof shall have ground glass panels or transoms.

471. **Sinks—Requirements.)** In every new tenement house there shall be in each apartment at least one kitchen sink with running water. In every existing tenement if there be not one such sink in each apartment there shall be on every floor at least one kitchen sink with running water, accessible to all the tenants of the floor, without passing through any other apartment. In no tenement house shall there be woodwork inclosing sinks; the space underneath sinks shall be left entirely open.

472. **Pipes Through Floors—Catch Basins—Water Closets.)** (a) In every new tenement house where plumbing or other pipes pass through floors or partitions, the openings around such pipes shall be sealed tight with plaster or other incombustible material, so as to prevent the passage of air or the spread of fire from one floor to another or from room to room.

(b) In the premises of a tenement house the catchbasin shall, whenever practicable,

be placed in a court or yard, and shall be covered with a stone or iron cover, flush with the surface so that access to such basin shall be convenient.

(c) Where it is for any reason impracticable to place a catchbasin in a court or yard, the Commissioner of Health may authorize the use of an iron catchbasin with air-tight cover, located in the cellar or basement.

472½. **Buildings Damaged by Fire, Etc.)** If any existing tenement house is hereafter damaged by fire or other cause, including ordinary wear, so that at any time its value be less than one-half its original value exclusive of the value of the foundations, such building shall not be repaired or rebuilt except in conformity with the provisions of this ordinance applicable to new tenement houses.

473. **Provisions of this Article Not to Apply to Existing Buildings, Except Under Certain Circumstances—Then Commissioner to Notify.)** (a) Nothing in this Article contained shall be construed as requiring alterations in the construction or equipment of buildings in existence at the time of the passage of this Article and which at the time of their construction were built in compliance with the ordinances then in force, unless they are in conflict with the requirements of Sections 447, 466, 471, 475, 476, 477, 468, or unless such buildings shall not have sufficient or adequate means of egress therefrom, by reason of insufficient or inadequate stairways, improperly located or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress.

(b) Where it shall appear to the Commissioner of Buildings that any such building has insufficient means of egress therefrom as aforesaid, he shall notify the owner, agent or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building, as are necessary to be made in order to promote the safety of the occupants of such building and of persons using the same and of the public.

474. **Rooms and Halls—Additional.)** Every room or hall that may hereafter be constructed or created in an existing tenement house shall comply in all respects with the provisions of this ordinance as to size, arrangement, light and ventilation of rooms and halls.

*475. **Rooms—Change in Existing.)** No room in any now existing tenement house shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a window having a superficial area not less than one-twelfth of the floor area of the room, which window shall open upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet *and a minimum width of not less than two feet six inches*, or unless such room adjoins another room in the same apartment, which other room shall have such a window opening upon such a street, alley, yard or court, between which two adjoining rooms there shall be *an alcove opening equal in extent to at least 20 per cent of the entire wall surface of said room, provided, however, that all of the requirements of Sections 439 and 440 of The Chicago Code of 1911 shall be complied with.*

Where a frame tenement house is moved from one lot to another, or from one location to another on the same lot, it shall comply with the provisions of Section 452 of this Chapter.

*Amended July 8, 1912.

476. **Windows—Courts—Attic.)** No room in any now existing tenement house, which has no such window as aforesaid, opening upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet, shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a floor area of at least sixty square feet and also at least six hundred cubic feet of air space; nor unless every part of the finished ceiling of such room be at least seven feet six inches distant from every part of the finished floor thereof; provided, that an attic room need be seven feet six inches high in but one-half of its area, and, provided, further, that such attic room has not less than seven hundred fifty cubic feet of air space therein; and such attic room shall not be used for purposes of human habitation other than as a sleeping room.

*477. **Existing Tenements—Living Rooms in Cellars or Basements—When Permitted.)** (a) In every existing tenement house, no room in an existing cellar or basement shall be occupied for living purposes unless such room shall be at least seven feet six inches high in the clear, and have not more than four feet eight inches of such cellar or basement below the finished grade at building; provided that no such room shall be used for living purposes unless such room shall have a window opening upon a street, alley, yard or court, and, provided, that when the windows of any living room front solely upon a street and the floor of such basement is four feet eight inches below the sidewalk grade, such windows shall be located not less than three feet back of the lot line; provided, however, that in every case where the height of ceiling of any living room is less than eight feet six inches in the clear, the window area of such room shall be at least 15 per centum of the floor area.

(b) When a brick or frame tenement house is moved from one lot to another, or from one location to another on the same lot and a basement or story, or both, is constructed under the same, the total height of which is more than six feet six inches from the floor to the ceiling, the walls of such basement shall be constructed of masonry according to the provisions of Section 638 of The Chicago Code of 1911, and the habitable rooms therein shall comply with the provisions of Section 475 of The Chicago Code of 1911, and the space on the lot shall comply with the provisions of Section 439 and Section 440 of The Chicago Code of 1911.

*Amended July 8, 1912.

477½. **Insanitary Conditions—Nuisance.)** A tenement house or part thereof which is in an insanitary condition by reason of the basement or cellar being damp or wet, or by reason of the floor of such basement or cellar being covered with stagnant water or by reason of the presence of sewer gas, or by reason of any portion of such building being infected with disease, or being unfit for human habitation, or which by reason of any other insanitary condition is a source of producing sickness among the inhabitants of this city, or which in any way endangers the public health, is hereby declared to constitute a public nuisance.

ARTICLE X.

Class VII.

478. **Class VII Defined.)** In Class VII shall be included every building used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as a department store.

478½. **Must Comply With General and Special Provisions.)** Every building of Class VII shall comply with the general provisions of this chapter, and, in addition to the general provisions, shall comply with the following special provisions:

479. **Buildings of Class VII—Construction of.)** Buildings three stories or less in height, used either wholly or in part for the purpose of Class VII, may be of ordinary

construction. Such buildings more than three and not exceeding five stories in height shall be of slow-burning, mill or fireproof construction. Such buildings over five stories in height shall be of fireproof construction.

480. **Stores Used for Retail Sale of Goods or Manufacturing Purposes—Occupation of Basement—Lockers.)** (a) Not more than the lower twelve stories above the street grade shall be used for the retail sale of goods, or for locker provisions in excess of accommodations for the number of employes on the floor on which they are employed, or for manufacturing purposes in a building devoted wholly or in part to purposes of Class VII except as hereinafter provided; provided, however, the stories above the twelfth story may be used for these or other purposes when equipped with an approved automatic sprinkler system approved by the Fire Marshal; and further provided, that all such buildings hereafter erected to be used for these purposes, or so used, above the twelfth story shall in addition to being equipped with an approved automatic sprinkling system have enclosed stairways.

(b) Not more than one floor of any basement or cellar shall be used for the retail sale of goods. Such floor shall be the nearest to the inside street grade. Such floor used for the retail sale of goods shall not be more than twenty feet below the inside street grade.

(c) No sub-basement, cellar or part of a basement below such floor shall be used for the sale of any goods in any manner, but locker and dressing rooms may be placed in the sub-basement, provided the space thus occupied be separated from the remainder of the basement by fireproof partitions, and that there be at least two flights of stairs placed as far apart as practicable leading therefrom to the first floor, inclosed in fireproof partitions. Such stairs from such locker or dressing rooms shall be, in addition to other stairways required by this chapter for such buildings, and at least one of such stairways shall open directly on a street, alley or court opening on a street or alley, or on a fireproof passage leading to the street, alley or such court. Where more than five lockers are in one room, such lockers shall be of incombustible material.

(d) Where stories above the twelfth story are used for the purposes of Class VII as hereinbefore described for locker provisions in excess of accommodations for employes on the floor on which they are employed, then the stairways from the first to the topmost floor shall be built and inclosed as described in Section 668, but the stairways shall be in number and aggregate width as required in the table for stairways set forth in Section 666 of this chapter.

481. **Floor Areas—Maximum.)** (a) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of ordinary construction shall not exceed nine thousand square feet.

(b) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of slow-burning or mill construction shall not exceed twelve thousand square feet.

(c) The floor area, except as hereinafter provided, of any one story or portion of a story used for the purposes of Class VII of any building of fireproof construction shall not exceed 25,000 square feet, unless the building is completely equipped with an approved automatic sprinkler system, but in no case shall such area exceed 30,000 square feet.

482. **Floor Areas—Exceeding the Maximum Limits Defined in Section 481.)** (a) Where any floor or portion of a floor used for the purposes of Class VII in any building shall exceed in area the maximum number of square feet allowed in the preceding section for the type of construction of such building in which such floor is contained, each such maximum amount of floor area so used shall be separated from other parts of such floor by fire walls, or dividing walls built in accordance with the provisions of Section 250 of this chapter relating to dividing walls in buildings of Class I.

(b) Where any such floor so used is divided by such fire walls or dividing walls, each such division of such floor shall be provided with stairs, aisles, exits, and fire escapes as required in this chapter for separate and distinct buildings, and each such division shall be considered as a separate building, except as provided in Section 508 of this chapter.

483. **Galleries.)** (a) The area of any or all of the galleries, mezzanine or intermediate floors in any one story used wholly or in part for the purposes of Class VII in any building shall not exceed ten per centum of the area of such story. Galleries, mezzanine or intermediate floors of a larger size than the above shall be considered as full stories.

(b) Every gallery, mezzanine or intermediate floor shall have at least one stairway not less than three feet wide.

(c) The height from the floor of any gallery, mezzanine or intermediate floor to the ceiling over same shall not be less than seven feet, and there shall be not less than seven feet of space between the bottom of such gallery, mezzanine or intermediate floor and the floor of the story in which such gallery, mezzanine or intermediate floor is placed.

(d) Every gallery, mezzanine or intermediate floor in any building used for the purposes of Class VII shall be built to conform to the construction applicable to such building, but galleries not exceeding five per centum of the area of such story, may be built of incombustible material without fireproof protection.

(e) No gallery, mezzanine or intermediate floor shall be built without a permit from the Department of Buildings, and plans showing the construction and size of such proposed gallery, mezzanine or intermediate floor shall be filed with the Department of Buildings when a permit is applied for.

484. **Courts of Class VII Buildings.)** (a) Every court or light shaft of every building used wholly or in part for the purposes of Class VII shall be open and unobstructed from the bottom of such court to the sky, with the exception that fire escapes may be built therein, and such courts shall have walls constructed in the same manner as is required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

(b) All windows, doors or other openings in court walls of such buildings shall have metal frames, metal sashes and metal doors, with the glazed portions thereon of wired glass.

485. **Stories—Number of.)** The first story above the inside street grade shall be designated and known as the first story for all purposes of this chapter, and the stories above shall be numbered consecutively, the second, third, and so on.

486. **Stairs — Halls — Passageways and Aisles—Signs and Lights.)** (a) The stair halls, passageways and stair aisles shall be unobstructed and be as wide as the stair and not less than four feet wide in the clear.

(b) The exit door or doors between floors and stair halls shall be not less than ninety per centum of the width of the stairway to which they afford access, and for each

elevator opening into such a stair hall, the doors to floors shall be increased six inches in width.

(c) The stairways and stair halls of any building used wholly or in part for the purpose of Class VII shall be illuminated by gas or electric light, and the gas piping and the electric wiring shall be accomplished by piping and circuits separated and distinct from the general illuminating piping and circuits of the premises. Each stair light shall have a red glass inclosure.

(d) At the bottom of each such stairway there shall be an illuminated red glass sign with the number of the story in which it is situated inscribed thereon in letters not less than six inches high.

487. **Aisles in Class VII Buildings.)** (a) In buildings used wholly or in part for the purposes of Class VII there shall be aisles in such portions of the buildings as are used for such purposes, connecting the stairways and the elevators directly with the street or alley doors, and such aisles shall be termed "main aisles." Such main aisles shall have a clear width equal to the width of the stairways connecting therewith, and for each elevator connecting with such an aisle there shall be an additional width of six inches, and no such main aisle shall be less than five feet wide in the clear between the counters in any department store or between the fixed seats therein. One-third the width of any basement stairway shall be added to the width of the main aisle connecting with such stairway.

(b) If there is a column in any such aisle, then the width of the aisle shall be increased by the width of such column.

(c) If there is a counter, or counters, or settee, or any case, or other obstruction in an aisle, then that part of the aisle on each side of such counter, bench or case, or other obstruction shall be considered as a separate aisle. No aisle shall be less than three feet in width.

488. **Exit Signs and Lights.)** (a) All exits in buildings used wholly or in part for the purposes of Class VII shall be clearly indicated by illuminated red signs with the word "Exit" thereon in letters not less than six inches high. At the bottom of each stairway on the street floor level there shall be similar signs indicating the direction of the nearest exit to a street or alley.

(b) Fire escape doors or windows shall be indicated by illuminated red signs with the words "Fire Escape" thereon in letters not less than six inches high.

*489. **Doors at Street Level—Revolving Doors.)** *The clear width of the exit openings shall be computed in the same manner as that provided in this article for main aisles, and no door openings shall be less than five feet wide, and all doors shall swing outward. Revolving doors shall not be considered as complying with this section unless the revolving wings of such revolving doors are so arranged that by the application of a force slightly more than is necessary to revolve said doors and which one person of ordinary strength is capable of exerting, all the wings of said doors fold flat on each other and in an outward direction, or unless the revolving wings of said revolving doors are so arranged that they may be readily collapsed or removed by pressure or simple mechanical means, to be approved by the Commissioner of Buildings, and leave sufficient opening for two or more persons to pass through with a minimum width of not less than twenty-two inches on each side of said collapsed doors.*

Where revolving doors are used as exits they shall be credited as exits only to the extent of the clear space remaining when the doors are collapsed, and all deficiency of required exits must be made up by additional doors.

*Amended February 20, 1911.

490. **Doors in Dividing Walls.)** (a) Door openings may be built in dividing walls of such buildings; provided, however, that such door openings shall be not less than five feet in width and shall be provided with fire-proof doors built as described in Section 573 of this chapter, and that each door shall have an efficient closing device which will operate automatically in the event of a fire in close proximity to either side of such door.

(b) Each such opening shall have exit signs and lights as provided for street doors and exit signs in Section 488 of this chapter. There shall be aisles not less than five feet in width connecting with such doors from the main aisles, and in no case shall any such door be less than ninety per centum of the width of the aisle directly connecting therewith.

491. **Loads—Allowance for Live Loads in Construction of Floors of Buildings of Class VII.)** For all buildings of Class VII the floor shall be designed and constructed in such a manner as to be capable of supporting, in addition to the weight of the floor construction, partitions, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors, and shall be figured in accordance with Section 516 of this chapter.

ARTICLE XI.

Class VIII.

492. **Class VIII Defined—Provisions of.)** In Class VIII shall be included every building used for school purposes and having a seating capacity of more than one hundred students.

492½. **Must Comply With General and Special Provisions.)** All buildings of Class VIII shall comply with the general provisions of this chapter wherever the same are applicable thereto, and in addition to the general provisions shall comply with the following special provisions:

493. **Construction of.)** (a) All buildings hereafter erected and used or intended to be used wholly for the purposes of Class VIII shall be constructed in accordance with the provisions of this chapter relating to Class VIII; and existing school buildings shall comply with the provisions of Class VIII with reference to stairs, exits and fire escapes.

(b) Buildings which have a seating capacity of two hundred or less and which are not over two stories and basement in height, may be built of ordinary construction; provided, that no portion of such building shall be used for assembly hall purposes.

(c) Buildings which have a greater seating capacity than two hundred and not exceeding four hundred, and which are not over three stories and basement in height, shall be built of slow-burning or fireproof construction.

(d) Buildings which have a greater seating capacity than four hundred, or which are more than three stories and basement in height, shall be built entirely of fireproof construction.

(e) Additions to existing buildings shall be built of the several types of construction required by this section; provided, however, that the sum total of the seating capacity of the entire building, including additions, shall be counted in determining the type of construction required for such addition.

(f) All alterations in existing buildings used for the purposes of Class VIII, other than new additions thereto, and intended to make them comply with the requirements of this chapter, may be executed in the same kinds of materials originally used in such buildings, unless otherwise distinctly provided herein.

494. **Walls—Window Openings in.)** No wall of any building used for the purposes of Class VIII and containing a window opening shall be nearer than five feet to any lot line of adjoining property, street and alley lines not included.

495. **Portable Frame Buildings.)** Portable frame buildings used wholly for the purposes of Class VIII, not larger than 28 by 36 feet and not over one story high, may be erected, provided exterior walls and roof of same are covered with metal or other incombustible material, and the interior woodwork painted with fire-retarding paint approved by the Commissioner of Buildings; and, provided, further, that the location of such buildings shall be approved by the Commissioner of Buildings. Such portable buildings shall not be located nearer than ten feet to any other building, and shall not be maintained on any one lot or block for a longer period than two years after the date of the issuance of the original permit.

496. **Assembly Halls—Limitations as to Seating Capacity and Floor Level.)** (a) The limit of height at floor level and the maximum seating capacity of assembly halls or auditoriums or other single rooms in buildings of this Class must not exceed the numbers given in the following table, for the specified type of construction, to-wit:

Floor—Height of Above Grade.	——Type of Construction—— Fireproof Construction.	Slow burning or Mill Construction Having Fireproof Stairs and Corridors.	Ordinary Construction.
	Persons.	Persons.	Persons.
Over 60 ft.....	500	100	...
60 ft. or less..	600	300	...
45 ft. or less..	700	500	...
30 ft. or less..	1000	800	250
20 ft or less..	1500	900	500
10 ft. or less..	2000	1000	800
5 ft. or less..	2500	1200	1000

(b) All assembly halls or other single rooms having a seating capacity larger than that given in the above table must have the highest part of the main floor within not more than one foot of grade level and must have exits leading directly to three streets, public alleys, or to open public grounds.

(c) Seating capacity of all assembly halls in buildings of this Class shall include the total aggregate seating capacity of all balconies, galleries, stages and platforms as well as the main portion of such assembly hall or rooms.

(d) Heights of assembly hall floors shall be measured from sidewalk level at entrance of building or open school grounds to highest part of main floor of such assembly hall or rooms.

497. **Stairways—Width of.)** (a) Stairways in buildings used for the purposes of Class VIII shall be equivalent in width to fifteen inches for every hundred of seating capacity in such building as measured by the aggregate seating capacity of the auditorium, assembly rooms and school rooms; provided, however, that the number of persons allowed in such buildings at any one time shall be limited by the width of stairways available as exits therefrom.

(b) No stairway shall be less than four feet in the clear, except where more than two stairways lead down from any floor, in which case stairways three feet in width in the clear may be counted in the total width of stairs required.

(c) Where two or more stairways are used, they shall be placed at opposite ends of the building or as far apart as practicable, and all such buildings hereafter erected shall have at least two separate and distinct stairways from the ground floor to the top floor, and all existing buildings shall have two such separate and distinct stairways, or one stairway and one sliding or stairway fire escape.

(d) All stairways shall have railings on each side thereof. No stairway shall ascend a greater height than thirteen feet six inches without a level landing, the dimensions of which, in the direction of the run of the stairs, shall be not less than four feet, or which, if at a turn of the stairs, shall be of not less width than the width of the stairs. No winder shall be permitted in any stairs. Stairways which are over nine feet wide shall have double intermediate handrails with end newel posts at least five and one-half feet high. All stairways shall discharge at the bottom directly to a public thoroughfare or open ground.

498. **Stairways in Buildings Hereafter Erected—Fireproof.)** In buildings hereafter erected more than two stories and basement in height, the stairways and their enclosing walls shall be of fireproof construction.

499. **Width of Corridors, Passageways, Hallways and Doorways.)** The width of corridors, passageways, hallways and doorways shall be equivalent in width to eighteen inches for every one hundred of seating capacity of such portions of building as will be required to use same for exit. No corridor, passageway or hallway shall be less than five feet in width, and no doorway less than three feet in width, except where two or more doors, each two feet eight inches or more in width, are grouped together.

500. **Doors to Open Outward—Covering of.)** All doors in such buildings shall open outward, and all entrance and exit doors shall be unlocked at all times when the building is occupied for school purposes, or open to the public. All exit doors from assembly halls to other parts of the building shall be covered with metal or other fireproof material approved by the Commissioner of Buildings.

501. **Aisles—Width of—In Assembly Halls and Recitation and Study Rooms Must Be Kept Clear of Obstructions.)** (a) Aisles in Assembly halls in such buildings shall be equivalent in width to eighteen inches for every one hundred of seating capacity in such assembly hall, but no such aisle shall be less than two feet six inches wide in its narrowest part. All groups of seats shall be so arranged that they shall have an aisle on each side, and not more than twelve seats in any one row shall be placed between aisles.

(b) Aisles in class rooms, recitation rooms and study rooms of such buildings shall be equivalent in width to eighteen inches for every one hundred permanent seats in any such room, but no aisle shall be less than sixteen inches in width and no main to cross aisle be less than two feet six inches in width.

(c) All aisles and passageways in such buildings shall be kept free from campstools, chairs, sofas and other obstructions, and no person shall be allowed to stand in or occupy any such aisle or passageway during any performance, service, exhibition, lecture, concert or any public assemblage.

502. **Emergency Exits for Assembly Rooms—Aggregate Width of.)** All assembly halls of such buildings having a seating capacity of eight hundred or more shall be provided with at least two emergency exits. The aggregate width of such emergency exits, which shall be provided for each floor, balcony or gallery of such assembly hall, shall be not less than nine inches in width for every one hundred of seating capacity or portion thereof. No emergency exit or stairway shall be less

than three feet in width. Emergency exits must be located as far apart and as far from main exits as practicable, subject to the approval of the Commissioner of Buildings.

503. **Exits — Signs.)** All exits opening from assembly halls of such buildings shall have the word "EXIT", in letters at least six inches high, applied to the auditorium side of every such exit, and when such assembly hall is in use at night, a red light shall be kept burning over the word "EXIT" during the entire time and until the pupils and audience have left the building.

504. **Lights in Buildings—Windows—Skylights.)** (a) Every portion of any such building devoted to the uses or accommodation of the public and all outlets therefrom leading to the streets, including the open courts and corridors, stairways, and exits, shall be well and properly lighted during the entire time such portion is in use, and shall remain lighted until all the pupils and the audience have left the premises.

(b) All gas or electric lights in the class rooms of main building and in halls, corridors, lobbies, stairs and exits leading from the assembly halls shall be independent of lights in assembly hall. By "independent" shall be construed a separate pipe from meter or separate circuits from switchboard.

(c) The total glass area of outside windows and skylights of each class room, recitation room or study room in such buildings shall be not less than one-fifth of the floor area of such room.

(d) Class rooms, recitation rooms and study rooms that have exterior windows on one side only must have the top of glass in such windows at a height above the floor of such room of not less than one-half of the distance to the opposite parallel wall or partition.

(e) Such rooms having exterior windows on two opposite sides of the room shall have the top of glass in such windows not less than one-fourth the distance between walls in which the windows are placed. The height of windows in corner rooms having windows in adjacent walls shall be computed from nearest wall or partition to opposite window.

(f) Where skylights or skylights and windows of sufficient size to give the proper glass area are used these heights of windows shall not be required.

*505. **Scenery—Sliding Curtains—Screens—Fireproofing Same—Hand Pumps—Fire Extinguishers.)** No curtains or scenery shall be used in any assembly hall, except only that it shall be permissible to use a pair of sliding curtains hung on horizontal metal rods not over twelve feet above the floor of stage and portable screens set on the floor and not over eight feet high: *Provided, however, in assembly halls located on the first floor or ground floor of a fireproof building, it shall be permissible to use curtains hung from the ceiling or top of proscenium opening.*

*Amended July 28, 1913.

*505½. **Moving Picture Machines.)** *Moving picture machines may be installed and used in assembly halls located on the first floor or ground floor of fireproof buildings of Class VIII. When moving picture machines are so used they shall be located in booths constructed of fireproof materials with metal clad doors and a vent duct to the outside air having a cross sectional area of at least 100 square inches.*

*Amended (by adding new Section 505½) July 28, 1913.

506. **Basement When Used for Class Rooms.)** (a) In every such building in which the lower or basement floor is below the surface of the ground surrounding such building, and is used in part or as a whole for heating or ventilating apparatus, such floor shall be considered the basement story of such building.

(b) Class rooms, recitation rooms or study rooms shall not be allowed in basements less than twelve feet in height in the clear nor where the floor is more than two feet below the level of the sidewalk at nearest entrance of building nor in basements which are not properly lighted by windows or skylights as defined elsewhere in this Chapter for such rooms.

507. **Stories—Height of.)** No story above the basement shall be less than twelve feet in height in the clear.

*508. **Fire Escapes.)** *(a) Every building used for the purposes of Class VIII of four or more stories in height shall be provided and equipped with stairway fire escapes or sliding fire escapes as herein provided.*

*Amended February 20, 1911.

(b) All such buildings having a seating capacity of less than two hundred on any one floor above the second floor shall have at least one such fire escape.

(c) All such buildings having a seating capacity of over two hundred but less than four hundred in any one story above the second floor shall have at least two such fire escapes.

(d) All such buildings having a seating capacity of more than four hundred but less than six hundred on any floor above the second floor shall have at least three such fire escapes.

(e) At least one additional stairway or sliding fire escape shall be provided for every increase of two hundred seating capacity in any one story above the second floor.

(f) Stairway fire escapes shall be built in accordance with the requirements of Sections 669, 670 and 673, and shall be subject to the approval of the Commissioner of Buildings.

(g) Sliding fire escapes shall be securely anchored or fastened to the building and shall have a radius or width of not less than thirty-six inches, and the inner side of the same shall be entirely smooth and made of metal. There shall be an entrance to each sliding fire escape from each floor above the first story. They shall be of a pitch of not less than thirty degrees nor more than forty-five degrees for straight runs. They shall be so constructed that they will discharge people not more than twenty-four inches from the adjacent ground or floor. They shall be of such pattern and design as will best secure the safety of the public, and their construction, location and maintenance shall be subject to the approval of the Commissioner of Buildings. Spiral sliding fire escapes shall have two complete turns for each story height of more than thirteen or less than sixteen feet.

(h) All the provisions of this Chapter relating to outside sliding or stair fire escapes shall apply to buildings of Class VIII, unless such buildings are fireproof, in which case interior fire escapes from ground to roof may be substituted for exterior fire escapes, provided such interior fire escapes shall comply with each and all of the following conditions:

(i) Interior fire escapes in fireproof buildings shall be enclosed in brick or concrete walls on all sides from top to bottom, and shall be enclosed at the top with a fireproof penthouse. The treads and risers of such interior fire escapes shall be the same as those used for stairs elsewhere in the building and the width of such fire escapes shall not be less than forty inches in their narrowest part between hand rails.

(j) The landings of such fire escapes shall, exclusive of and in addition to the space covered or occupied by swinging doors, be at least equal to the stairs in width. All doors leading to such fire escapes shall be incombustible doors and the glass portion thereof shall be glazed with polished wired glass not less than one-quarter of an inch thick, which shall be large enough to enable persons to see other persons on the opposite side of the door. The combined width of said doors on each landing shall exceed the stair width twenty-five per cent, but no single door shall be more than three feet wide. They shall be hinged and equipped with automatic opening and closing devices and shall open outward. Windows lighting such fire escapes shall have metal frames and sash and wired glass.

(k) The number and capacity of such interior fire escapes shall in no case be less than is elsewhere in this Chapter required for outside fire escapes, and the locations of the same shall be as far apart as practicable and so placed as to best secure the safety of the persons using the same in case of fire, accident or panic.

(l) Such interior fire escapes which comply with all the conditions above enumerated may be used daily as ordinary stairs.

509. **Inspection—Duties of Engineer—President of Board to Report to Fire Marshal.)** (a) It shall be the duty of the engineer of every building used for the purposes of Class VIII under the control of the Board of Education of this city, where an engineer is employed, or, in case no engineer is employed at such building, it shall then be the duty of the janitor of such building to examine all fire escapes on such buildings from the topmost story to the ground and to examine and operate all doors, windows and platforms leading to and from such fire escapes at least once each and every week that such building is used for school purposes, and to make a written report of such examination to the President of the Board of Education, showing the time it was made and the condition of the fire escapes.

(b) It shall be the duty of the President of the Board of Education to make a written report to the Fire Marshal at least three times a year, showing all such examinations made and the condition in which all fire escapes were found at the time of inspection; also the condition of the doors, windows and platforms leading to and from such fire escapes.

(c) It shall be the duty of the person in charge of each building used for the purposes of Class VIII, other than school buildings under the control of the Board of Education of this city, to make an examination of the fire escapes on school buildings under their charge, from the topmost story to the ground, and to examine and operate all doors, windows, and platforms leading to or from such fire escapes at least once each and every week that such building is used for school purposes, and to make a written report to the Fire Marshal at least three times each year, showing all such inspections made and the condition in which fire escapes, doors, windows and platforms were found at the time of the inspection.

(d) Such fire escapes shall be kept in good condition, ready for immediate use at any and all times that such building is in use and shall be kept free from snow and ice.

(e) The duties herein imposed by this Section shall not be held to relieve the Fire Marshal or Commissioner of Buildings from performing such duties as are otherwise required of them by this Chapter.

510. **Fire Drill—Written Report to Fire Marshal.)** (a) The principal or other person in charge of the pupils of every building used for the purposes of Class VIII shall establish and maintain a good and efficient fire drill, which shall be practiced at least twice every month during the time such building is used for school purposes.

(b) A written report shall be made by the principal or other person in charge of the pupils in all school buildings under the control of the Board of Education of this city to the President of said Board of Education of each fire drill held and of the time that elapsed from the first fire signal until the last person was out of the building.

(c) It shall be the duty of the President of the Board of Education to make a written report to the Fire Marshal at least three times each year, which report shall contain a record of all such fire drills practiced in each of the school buildings under the control of the Board of Education of the city.

(d) It shall be the duty of the principal or other person in charge of school-buildings, other than those under the control of the Board of Education, to make a written report to the Fire Marshal at least three times each year, showing a record of each fire drill held and the time that elapsed from the first signal until the last person was out of the building.

(e) The duties herein imposed in this Section shall not be held to relieve the Fire Marshal or Commissioner of Buildings from performing such duties as are otherwise required of them by this Chapter.

511. **The Commissioner of Buildings, the Fire Marshal, City Electrician and Superintendent of Police Shall Close Buildings for Violations.)** The Commissioner of Buildings, Fire Marshal, City Electrician and Superintendent of Police, or any of them, shall have the power to close or order closed any building used wholly or in part for the purposes of Class VIII wherein there is any violation of the provisions of this ordinance, and to keep the same closed until such provisions are complied with.

ARTICLE XII.
General Provisions.

512. **Construction or Alteration of Building — Requirements.)** Every building or structure or part thereof, hereafter constructed, erected, altered, enlarged, repaired or changed within the City shall be so constructed, erected, altered, enlarged, repaired or changed, in accordance with the provisions of this Chapter.

513. **Class of Buildings Not to Be Changed Without Conforming to Provisions of This Chapter.)** If buildings, the uses of which bring them within any of the classes mentioned in this Chapter, are to be applied to the uses of any other class for which a better system of construction is required by this Chapter, the construction and equipment of such buildings shall first be made to conform to the requirements of this Chapter as specified for their intended use. And it shall be unlawful to use any such building for a new or different purpose from that to which its structure and equipment adapts it under this Chapter, unless the requirements of this Chapter for such new or different use shall first have been complied with, and a permit for such alteration or use shall have been first obtained from the Commissioner of Buildings.

514. **Alterations of Existing Buildings.)** (a) In construing the several sections of this Chapter, said sections shall not be construed as requiring alterations in the construction or equipment of buildings or structures in existence at the time of the passage of this Chapter, except where specifically provided, unless such buildings shall not have sufficient or adequate means of egress therefrom or ingress thereto, by reason of insufficient or inadequate stairways or stairways improperly located or insufficient or inadequate elevators or ele-

vator equipment, doors, fire escapes, windows or other means of egress or ingress and except also in sections which are herein made retroactive.

(b) Whenever an Inspector of Buildings shall make a report to the Commissioner of Buildings that any such building has inadequate or insufficient means of egress therefrom or ingress thereto, as aforesaid, the Commissioner of Buildings shall notify the owner, agent, or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building as are necessary to be made in order to make such building comply with the requirements of this Chapter.

(c) If, however, it is desired to enlarge, or in any manner materially modify the construction of any existing building, or to make a change in its use or occupation which will transfer it from one class as recognized by this Chapter to another class, then, before such enlargement or structural change or modification of building is made, or before such change in its use or occupation may be made, written notice shall be given to the Commissioner of Buildings of the intention to change the character of the use, and the entire building shall be reconstructed or modified in such manner as to bring the same, when enlarged or altered, or when occupied for its new and different purposes, into compliance with the provisions of this Chapter.

*515. **Removal of Brick, Stone, Frame or Concrete Buildings.)** It shall be unlawful for any person, firm or corporation to move any brick, stone, *frame* or concrete building from one location to another, unless the same shall be altered or re-constructed so as to conform to the ordinances governing the construction of such building at the time of moving the same and in its new location; *provided, however, that whenever a tenement house is moved, the same shall be made to comply with the requirements of Section 475 and Section 477 of The Chicago Code of 1911, as amended.*

*Amended July 8, 1912.

516. **Live and Dead Loads—Wind Resistance.)** (a) The "dead load" shall include all permanent portions of the building, also partitions and permanent fixtures and mechanisms supported by the building.

(b) All buildings shall be designed to resist a horizontal wind pressure of 20 lbs. per square foot for every square foot of exposed surface. In no case shall the overturning moment due to wind pressure exceed seventy-five per cent of the moment of stability of the building due to the dead load only.

(c) The "live" loads per square foot of floor areas, except stairs, for the classes of buildings except portions of Class VIII as hereinafter provided shall be not less than the following:

	Pounds.
Class I	100
Class II	50
Class III	40
Class IV	100
Class V	100
Class VI	40
Class VII	100
Class VIII	75

(d) Provided, however, that in Class VIII the portions of the building exclusive of the floors in assembly halls, the corridors and the stairs, shall not be required to be constructed to support a live load in excess of 40 pounds per square foot.

(e) The roofs of all buildings shall be designed and constructed in such a manner that they will bear a load in addition to the weight of their structure and covering, of at least twenty-five pounds for each square foot of horizontal surface.

(f) The live loads on stairways for buildings of all classes shall not be less than 100 pounds per square foot of treads and landings.

*517. **Structural Details—Strength Tests—How Made.)** (a) All structural details and workmanship shall be in accordance with accepted engineering practice, and subject to the approval of the Commissioner of Buildings.

(b) Floors, joists and beams shall be designed for the full dead and live loads. Floor girders shall be designed for the full dead and not less than eighty-five per cent of the live load.

(c) In buildings of Classes III and VI, except frame buildings, where the distance between enclosing walls or intermediate walls is more than twenty-five feet in the clear, intermediate supports for the joists shall be either brick, or concrete, or iron, or steel columns, beams, trusses, or girders.

*Amended February 20, 1911.

(d) If brick walls are used for this purpose, they may, in all cases where the thickness of walls is given, in Section 519, as 16 inches or more, be made four inches less in thickness than the dimensions stated.

(e) Tests shall be made by the owner, upon the demand of the Commissioner of Buildings, on all forms of floor construction involving spans over eight feet. Such tests shall be made to the approval of the Commissioner of Buildings, and must show that the construction will sustain a load equal to twice the sum of the live and dead loads, for which it was designed, without any indication of failure. The construction may be considered as part of the test load. Each test load shall remain in place at least twenty-four hours. On arch construction, this test load shall be placed on one-half of the arch, covering the area from the support to the crown of the arch.

518. **Walls, Piers and Columns—Dead and Live Loads.)** (a) The full live load on roofs of all buildings shall be taken on walls, piers, and columns.

(b) The walls, piers and columns of all buildings shall be designed to carry the full dead loads and not less than the proportion of the live load given in the following table:

Floor	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
17	85	per	cent.														
16	80	85															
15	75	80	85														
14	70	75	80	85													
13	65	70	75	80	85												
12	60	65	70	75	80	85											
11	55	60	65	70	75	80	85										
10	50	55	60	65	70	75	80	85									
9	50	50	55	60	65	70	75	80	85								
8	50	50	50	55	60	65	70	75	80	85							
7	50	50	50	50	55	60	65	70	75	80	85						
6	50	50	50	50	50	55	60	65	70	75	80	85					
5	50	50	50	50	50	50	55	60	65	70	75	80	85				
4	50	50	50	50	50	50	50	55	60	65	70	75	80	85			
3	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85		
2	50	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85	
1	50	50	50	50	50	50	50	50	50	50	55	60	65	70	75	80	85

(c) The proportion of the live load on walls, piers, and columns on buildings more than seventeen stories in height shall be taken in same ratio as the above table.

(d) The entire dead load and the percentage of live load on basement columns piers and walls shall be taken in determining the stress in foundations.

(e) In addition to the entire dead loads, not less than the following proportion of the percentage of live load on the basement columns, piers and walls shall be taken in determining the number of piles for pile foundations and the area of concrete caissons.

Classes I and VII..... 75 per cent.
Classes II, III and VI..... 50 per cent.
Classes IV, V and VIII.... 25 per cent.

In all foundations eccentric loading must be provided for.

*519. **Thickness of Walls and Columns—Construction—Width—Height.)** (a) Brick, stone, and solid concrete walls, except as otherwise provided, shall be of the thickness in inches indicated in the following table:

	Base-ment.	Stories										
		1	2	3	4	5	6	7	8	9	10	11	12
One-story	12	12											
Two-story	16	12	12										
Three-Story	16	16	12	12									
Four-story	20	20	16	16	12								
Five-story	24	20	20	16	16	16							
Six-story	24	20	20	20	16	16	16						
Seven-story	24	20	20	20	20	16	16	16					
Eight-story	24	24	24	20	20	20	16	16	16				
Nine-story	28	24	24	24	20	20	20	16	16	16			
Ten-story	28	28	28	24	24	24	20	20	20	16	16		
Eleven-story	28	28	28	24	24	24	20	20	20	16	16	16	
Twelve-story	32	28	28	28	24	24	24	20	20	20	16	16	16

(b) In Class VIII buildings the thickness of surrounding walls and of all dividing walls carrying loads of floors and roof shall be as indicated in the following table, to-wit:

	Base-ment.	Stories				
		1	2	3	4	5
	in.	in.	in.	in.	in.	in.
One story	16	12				
Two stories	16	16	12			
Three stories	16	16	16	12		
Four stories	20	20	16	16	12	
Five stories	24	20	20	16	16	16

(c) In Class VIII buildings, walls around stairs, elevators and air shafts and joist supports shall comply with the requirements of Section 641 of this Chapter.

(d) The basement walls of two-story buildings and the first story walls of three-story buildings in Classes III and VI may be twelve inches in thickness. The first story walls of one-story buildings and the second story walls of two-story buildings in Classes III and VI may be eight inches in thickness, provided that where a pressed brick face is used no wall shall be less than twelve inches in thickness, and an eight-inch brick or solid concrete partition wall may be built in a building of any class, but in no case shall any eight-inch brick wall be more than fourteen feet in height.

(e) The basement walls of two-story buildings in Classes II, III and VI may be 12 inches in thickness.

(f) In buildings of skeleton fireproof construction, the thickness of walls shall be governed by Section 623 of this Chapter.

(g) Walls less than fifty feet in length and walls less than fifty feet between cross walls, may be built four inches less in thickness than the thickness given in the aforesaid table, but no such wall in such buildings shall be less than twelve inches in thickness, provided, however, that such walls in buildings of Classes III and VI may be sixty-five feet in length; and further provided, that eight-inch walls may be used in one-story brick buildings and in the second story of two-story brick buildings of said last mentioned classes where said eight-inch walls are not more than fourteen feet in height and are supported by a foundation or wall not less than twelve inches in thickness.

(h) A brick wall not more than twenty-five feet long and forming one side of a brick shaft for stair, elevator or other purposes, need not exceed sixteen inches in thickness, nor its upper fifty feet twelve inches in thickness, provided that in no case shall the load on such brick wall exceed the safe load for brickwork prescribed by this ordinance.

(i) The length of a wall shall be the distance in which the walls extends in a straight line and shall be measured between angles of the masonry or between exterior and cross walls.

(j) Where masonry buttresses or piers or pilasters are employed on either or both sides of a wall, then said walls may be reduced in thickness by one-half of the projection or projections of the buttresses or piers or pilasters. The reduction in thickness may be made throughout the height of the wall, except that no 12-inch wall shall be higher than thirty feet and no 16-inch wall shall be higher than fifty feet. The stress in the brick work in any part of such walls shall not exceed the stress per square inch allowed by this Chapter on the kind of masonry employed. Buttresses or piers or pilasters shall be at least one-tenth as wide as the spacing between the buttresses or piers or pilasters. Twelve-inch walls or less between buttresses or piers or pilasters shall not be used where the distance between buttresses or piers or pilasters is greater than eighteen feet. Sixteen-inch walls or less shall not be used between buttresses or piers or pilasters where the distance is greater than twenty-four feet between buttresses or pilasters. Twenty-inch walls or less shall not be used between buttresses or piers or pilasters where the distance is greater than thirty feet between buttresses or piers or pilasters.

(k) Where buttresses are used, they shall be so placed that the principal girders and trusses shall bear on them.

(l) If the loads carried by trusses and girders are supported by iron, steel, or reinforced concrete columns, then such buttresses as are herein described shall not be required except for the fireproofing of steel and iron columns. The walls between such columns shall be built as required by this Chapter, and said walls shall be anchored to such columns by metal anchors in every seven feet to the height of such column.

(m) A structural floor system shall extend from one wall to an opposite wall, and the walls shall be anchored to floor joists or girders or both with iron anchors placed opposite one another, secured to the same joists or girders in pairs, every seven feet or less of length of said walls. Where said joists or girders are of such length that it is not practicable to make them of one piece,

then the several pieces shall be joined at each splice or joint by the tie plates or tie bars or other metal connections of the same strength as the anchors. Such anchors shall have not less than four-tenths of a square inch of metal in its smallest cross-sectional area. The spikes, bolts or screws, securing said anchors and tie plates, shall be of such number and size as to transmit the tensile strain which the anchor is capable of resisting into the joists or girders to which said anchors are connected. All pin anchors shall extend at least eight inches into the supporting masonry.

(n) The story height of buildings shall be the distance between structural floor systems or between such structural floor systems and structural roof systems and shall be as follows:

Where 12-inch walls are used, the story height shall not exceed 18 feet.

Where 16-inch walls are used, the story height shall not exceed 24 feet.

Where 20-inch walls are used, the story height shall not exceed 30 feet.

(o) Where the story height is greater than thirty feet, the walls shall not be of less thickness than the following: The upper fifteen feet shall be not less than sixteen inches in thickness, and the walls shall be increased four inches in thickness at each interval of fifteen feet or fractional part thereof of height.

(p) Curtain walls in skeleton construction buildings may be of hollow clay tile of the same thickness as herein required for brick walls.

(q) The walls of buildings to be used for the purposes of Classes III and VI and not more than two stories in height may be of hollow clay tile or moulded hollow concrete blocks not thinner than the thickness herein required for brick walls, subject to the approval of the Commissioner of Buildings.

*(r) *Interior brick walls used to support fireproof floor construction, where brick walls are not required by this chapter, may be built thinner than the thickness required by the provisions of paragraph (a) of this section, provided the proportion between the thickness of such walls and the free height between floors does not exceed fifteen, and further provided the unit stresses do not exceed the stresses allowed by this chapter, and provided, also, that no such wall shall be constructed of a thickness less than twelve inches.*

*Amended July 15, 1912.

520. **Ledges — Joist Supports.)** (a) In buildings two stories or more in height wherever party walls or partition walls twelve inches or less in thickness are used for the support of wood joists in buildings of Classes I, II, IV, V, VII and VIII the joists shall be supported on ledges of brick formed by corbeling not less than four courses of brick and the upper course shall project four inches beyond the face of the wall, and the joists shall be protected from the bottom to the top of same for the distance of the projection of the corbel by solid brick work laid in mortar.

(b) Wherever iron or steel joist and girder boxes having five complete sides of iron, nowhere less than ¼-inch in thickness, are used, corbels and ledges as herein specified may be omitted.

(c) In buildings of every class where wood furring is used on brick walls, the brick between joists shall be projected from the bottom of the joist to the top of the joist for the full thickness of the furring and in no case shall such projection be less than two inches.

521. **Walls of Altered Buildings—Increasing Thickness of.)** If the walls of a building are not of sufficient thickness to comply with the requirements of this Chapter for an enlarged or modified building, then the thickness of the existing walls shall be increased by building alongside of them a new wall, which shall not, however, be less in any part thereof than twelve inches thick, and which shall be increased in thickness by four inches for at least every forty feet in the height of such wall. Such new wall shall be laid in Portland cement mortar and shall be anchored to the old wall, but bonding with brick or masonry will not be considered as complying with this Chapter; and if an increase in the height of the building is contemplated, the wall from the top of the old wall shall be built jointly upon the new and old walls. If solid masonry buttresses are introduced in connection with such thickening and strengthening of existing walls, the intervening wall may be reduced to eight inches in thickness, provided such buttresses are sufficient in number and in area to make the resultant structure of equal strength with the solid wall already specified. Provided, however, that steel or iron columns or beams may be used instead of such new wall, such columns or beams to be bolted or bonded to the existing wall in a manner satisfactory to and approved by the Commissioner of Buildings.

522. **Walls—Party.)** The provisions of the preceding section shall also apply to all cases where existing party walls are to be joined to for the erection of new buildings. But in the case of party walls, which at the time of their erection were built in accordance with the terms of the city ordinances then in force, such walls, if sound and in good condition, may be used without increase of thickness for any building not higher than and of the same class as the building for which the original wall was built.

523. **Walls—Erection of—Walls and Skeleton Framework Securely Braced.)** In the erection of buildings of masonry construction, no wall shall be carried up at any time more than two stories above another wall of the same building. The walls and skeleton framework of all buildings shall be kept securely braced and otherwise protected against the effects of the weather during all building operations.

524. **Parapet Walls—When Required on Walls and Porches—Thickness and Height of.)** (a) On all flat roof buildings parapet walls shall be erected, except as hereinafter provided, on all exterior walls and on all partition walls required by this ordinance by reason of the area of such buildings; provided, that such parapet walls may be dispensed with on any wall of a fireproof building, and on street and alley walls and on yard and court walls of buildings of other types where the entire framing and materials of the roof are strictly fireproof or where all portions of the roof nearer than fifteen feet to the lot line of such street or alley or bounding such yard or court are protected against fire by a continuous covering of porus or hollow tiles, not less than two inches thick and surfaced with mortar, on top of the roof boards.

(b) Such parapet walls may be eight inches thick wherever this ordinance permits the use of eight-inch walls; elsewhere they shall be not less than twelve inches in thickness.

(c) Such parapet walls shall extend at any point not less than three feet vertically above the roof on all such required partition walls and on all other walls within less than three feet of any division lot line and approximately parallel therewith; elsewhere they shall extend not less than eighteen inches above the roof.

(d) On all buildings whose roofs have a greater pitch than three inches per horizontal foot, parapet walls, of thickness and height as above specified, shall be erected on required partition walls, on exterior

walls approximately parallel with and less than three feet distant from a division lot line, and on walls abutting on another building. Provided, that such parapet walls may be dispensed with where the entire framing and materials of the roof are fireproof or where the cornice and roof covering are of incombustible material and the top of the roof boards is protected against fire for at least five feet up from such wall by a coating of plaster on porus or hollow tiles at least two inches thick; and further provided that such parapet walls and such protection against fire may be dispensed with on buildings of Classes III and VI, three stories or less in height when such buildings have cornices of incombustible material and roof coverings of slate or terra cotta roofing tile.

525. **Allowable Stresses and Special Requirements for Foundations—Bearing on Various Soils.)** (a) If the soil is a layer of pure clay at least fifteen feet thick, without admixture of any foreign substance other than gravel, it shall not be loaded to exceed 3,500 pounds per square foot. If the soil is a layer of pure clay at least fifteen feet thick and is dry and thoroughly compressed, it may be loaded not to exceed 4,500 pounds per square foot.

(b) If the soil is a layer of firm sand fifteen feet or more in thickness, and without admixture of clay, loam or other foreign substance, it shall not be loaded to exceed 5,000 pounds per square foot.

(c) If the soil is a mixture of clay and sand, it shall not be loaded to exceed 3,000 pounds per square foot.

526. **Foundations in Wet Soil—Trenches to Be Drained.)** In all cases where foundations are built in wet soil, it shall be unlawful to build the same unless trenches in which the work is being executed are kept free from water by bailing, pumping, or otherwise, until after the completion of work upon the foundations and until all cement has properly set. In all cases a connection with the street sewer shall be established before beginning the work of laying foundations.

*527. **Foundations—Where not Permitted—Depth Below Surface—Independent of Underground Construction Owned or Controlled by the City.)** (a) Foundations shall not be laid on filled or made ground or on loam, or on any soil containing admixture of organic matter, and must rest on hard, sound soil. Foundations shall in all cases extend at least four feet below the finished surface of the ground upon which they are built, unless footings rest on bed rock.

(b) Foundations shall in all cases extend at least four feet below the surface of the ground upon which they are built, and in the case of all buildings 100 feet or more in height, foundations shall extend at least to the depth drained by the street sewer in the adjacent streets or alleys; but if such sewers are at a greater depth than ten feet below the sidewalk grade, such foundations need not extend to a greater depth than ten feet, provided that sound, hard soil is found at that depth.

(c) Every building forty feet or more in height, hereafter erected, which is located adjacent to any street or alley containing any then existing water main, water tunnel, sewer, conduit, tunnel, subway or other underground construction, owned or controlled by the City, shall be so constructed that the foundation or superstructure thereof shall not be supported in whole or in part by any such underground construction.

*Amended December 19, 1910.

528. **Foundation Construction.)** Foundations shall be constructed of stone, gravel or slag concrete, dimension stone or rubble stone, sewer or paving bricks, iron or steel imbedded in concrete or piles, or a combination of any of the same. All masonry foundations shall be laid in cement mortar.

529. **Foundation of New and Old Walls.)** In all cases where there is an increase in the thickness of walls, a new foundation shall be built in such a manner as to carry jointly both the new and old walls, and the soil under such foundations shall not be loaded beyond the limits specified in this Chapter.

All foundations shall be protected against the effects of frost, and cement mortar which has been affected by frost, shall not be used in building operations.

530. **Foundations—Pile Borings Required—Safe Load Required—Fiber Stress.)** (a) Where pile foundations are used, the Commissioner of Buildings may require auger borings of the soil to be made to determine the position of the underlying stratum of hard clay or rock. The heads of the piles shall be protected against splitting while they are being driven. The piles shall be sawed off to a uniform level at least one foot below Chicago datum after being driven, and the heads shall be imbedded in concrete or covered with a grillage so proportioned that in the transmission of the load from the structure to the pile the stresses in the materials shall not exceed that prescribed in this Chapter. The top of timber grillage shall be at least one foot below Chicago datum.

(b) The center of gravity of a pile foundation shall coincide with the center of gravity line of the load or loads which it carries.

(c) No pile of less than six inches diameter at small end shall be used.

(d) The safe load on a pile shall be determined by and shall not exceed the following formula:

$$P=\frac{2wh}{S+\frac{1}{10}} \text{ for steam hammer;}$$

$$P=\frac{2wh}{S+1} \text{ for drop hammer;}$$

In which formula
S=set in inches.
h=fall in feet.
w=weight of hammer.
P=safe load in pounds.

(e) The maximum load on a timber pile shall not exceed 50,000 pounds.

(f) A wood follower shall not be used in determining the safe load.

(g) Plans for pile foundations shall be submitted to the Commissioner of Buildings for approval and shall specify the least diameter of small end of piles, and no piles with smaller diameter of points than that specified for the job shall be used.

(h) There shall not be less than two rows of piles under all external party walls or other walls less than seventy feet high, and not less than three rows under all walls over seventy feet high, excepting under walls not exceeding fifty feet in height a single staggered row of piles may be used if other conditions of stability are complied with.

531. **Concrete Piles Allowable—Compression—Tests—How Made.** (a) Where concrete piles are used test piles shall be driven and loaded under the general direction of the Commissioner of Buildings.

(b) The allowable compression of concrete piles shall not exceed 400 pounds per square inch at a section six feet from the surface of the ground in immediate contact with the pile.

(c) These tests shall conform to the following regulations: Tests shall be made on at least two piles in different locations and as

directed by the Commissioner of Buildings. Not less than three piles to be driven for each test. The pile to be loaded to be driven first, the second pile to be driven within six hours of the driving of the first, the third pile to be driven within twenty to twenty-four hours after the first. The two latter shall each be driven with centers not to exceed twice the greatest diameter of pile, from the center of the test pile.

(d) The tests shall not be started until at least ten days after the piles to be loaded are driven, except that piles that have been cast and set up before driving may be tested as soon as practicable after driving. The piles shall be loaded with twice the proposed carrying load of the piles.

(e) The settlement shall be measured daily until twenty-four hours shows no settlement.

(f) One-half of the test load shall be allowed for the carrying load, if the test shows no settlement for twenty-four hours and the total settlement has not exceeded one one-hundredths of an inch multiplied by the test load in tons.

532. **Steel Rails or Beams in Concrete.)** If steel or iron rails or beams are used as parts of foundations, they shall be entirely imbedded in concrete extending not less then four inches beyond the metal.

533. **Allowable Stresses and Special Requirements for Masonry.)** (a) Allowable stresses in pounds per square inch on plain concrete and stone masonry shall not exceed the following:

	Lbs.
Coursed rubble Portland cement mortar	200
Ordinary rubble Portland cement mortar	100
Coursed rubble lime mortar	120
Ordinary rubble lime mortar	60
First-class granite masonry, Portland cement mortar	600
First-class lime and sandstone masonry, Portland cement mortar	400
Portland cement concrete 1-2-4 mixture, machine mixed	400
Portland cement concrete 1-2-4 mixture, hand mixed	350
Portland cement concrete 1-2½-5 mixture, machine mixed	350
Portland cement concrete 1-2½-5 mixture, hand mixed	300
Portland cement concrete 1-3-6 mixture, machine mixed	300
Portland cement concrete 1-3-6 mixture, hand mixed	250
Natural cement concrete 1-2-5 mixture	150

(b) Allowable compression in pounds per square inch on brick masonry shall not exceed the following:

	Lbs.
No. 1 paving brick, 1 part Portland cement, 3 parts torpedo sand	350
No. 2 pressed brick and sewer brick, mortar same as referred to above	250
No. 3 hard common select brick, Portland cement mortar, same as referred to above	200
No. 4 hard common select brick, 1 part Portland, 1 lime, 3 sand as referred to above	175
No. 5 common brick, all grades, Portland cement mortar	175
No. 6 common brick, all grades, good lime and cement mortar	125
No. 7 common brick, all grades, natural cement mortar	150
No. 8 common brick, all grades, good lime mortar	100

(c) Brick under Nos. 1 and 2 shall not crush at less than 5,000 pounds pressure per square inch of gross area.

(d) Brick under Nos. 3 and 4 shall not crush at less than 2,300 pounds pressure per square inch of gross area.

(e) Brick under Nos. 5, 6, 7 and 8 shall not crush at less than 1,800 pounds pressure per square inch of gross area. Sand lime brick, of this crushing strength may be used where common brick is permitted.

(f) Isolated piers of concrete, brick, or masonry shall not be higher than six times their smallest dimensions unless the above unit of stresses are reduced according to the following formula:

$$P \text{ equals } C \left(1.25 \text{ minus} \frac{H}{20D}\right)$$

In which formula

P is the reduced allowed unit stress.

C is the unit stress in the above table.

H is the height of the pier in feet.

D is the least dimension of the pier in feet.

(g) No pier shall exceed in height twelve times the least dimension. Weight of pier shall be added to other loads in computing load coming on the pier.

534. **Definitions of Masonry.)** All masonry construction shall be defined as and comply with the following:

(a) Ordinary Rubble shall be defined as masonry composed of unsquared stones laid without attempting any regularity of courses or bond;

(b) Coursed Rubble shall be defined as masonry having approximately level joints; stones to be roughly shaped so as to fit approximately; joints in wall or pier to be leveled off every three (3) feet in height and to be well bonded.

(c) First Class Masonry shall be defined as masonry built of stones in regular courses, the bearing surfaces of which as well as ends, to be roughly tooled off and shall be laid with alternate headers and stretchers so as to secure perfect bond.

535. **Ashlar Facing.)** (a) Ashlar facing of masonry walls shall only be considered as part of wall for the purpose of carrying weight, when it has a minimum bond as follows:

(b) Every second course to be a bond course, this bond course to extend into the backing a distance equal to the least thickness of ashlar. In addition to such bond, each stone in all courses shall be tied to backing by two galvanized iron anchors. No ashlar shall be less than four inches thick, nor shall the height of any stones exceed five times its thickness.

536. **Soft Bricks—Where Not Permitted.)** Soft bricks shall not be used in any part of a building where exposed to the weather, nor in external or internal piers of bearing walls.

537. **Brickwork—Bond of.)** The bond of all brickwork shall be formed by laying one course of headers for every five courses of stretchers; provided that in the case of pressed brick facing, two headers and a stretcher may be laid alternately in every sixth course or an equivalent number of full headers may be used in any other arrangement approved by the Commissioner of Buildings; and provided further, that pressed brick facing, when not counted as part of the bearing wall, may be laid with fewer or no header courses if anchored to the backing by metal ties of design, material, weight and quantity approved by the Commissioner of Buildings.

538. **Bricks—How Laid.)** All brick laid up in cement, or lime and cement mortar, shall be thoroughly drenched immediately before being laid unless laid in freezing weather. Both horizontal and vertical joints shall be filled with mortar in all kinds of brick masonry.

*539. **Allowable Stresses and Special Requirements for Timber.)** The maximum allowable stresses in pounds per square inch on actual sections for timber shall be as follows

	Extreme Fibre Stress and Tension with Grain.	Compression with Grain.	Compression Across Grain in Buildings Hereafter Erected.	*Compression Across Grain in Existing Buildings.*	Shear with Grain.
Douglas Fir and Long Leaf Yellow Pine....	1,300	1,100	250	*400*	130
Oak	1,200	900	500	*600*	200
Short Leaf Yellow Pine.....	1,000	800	250	*300*	120
Norway Pine	800	700	200	*300*	80
White Pine	800	700	200	*300*	80
Hemlock	600	500	150	*300*	60

The unit stress on timber posts shall comply with the formula:

$$C\ (1 = \frac{L}{80D})$$

In which formula:

C equals compressive strength of timber with the grain as given in the table.

L equals length in inches.

D equals least diameter inches.

The maximum length of a timber post shall not exceed thirty diameters.

Timber columns shall not be used in buildings of greater height than twice the width of the building nor in buildings over one hundred feet in height.

*Amended February 14, 1913.

540. **Quality of Timber.)** Timber used for building purposes shall be sound, well manufactured, close grained, free from wind shakes, or from dead, loose, decayed, encased or pitch knots, or knots and other defects that will materially impair its strength and durability.

541. **Maximum Allowable Stresses and Special Requirements for Metals.)** (a) The maximum allowable stresses in pounds per square inch in steel and iron shall not exceed the following:

	Rolled Steel.	Cast Steel.	Wrought Iron.	Cast Iron.
Tension on net section.....	16,000	16,000	12,000	.....
Maximum compression on gross section.....	14,000	14,000	10,000	10,000
Bending on extreme fibre.....	16,000	16,000	12,000	.....
Bending on extreme fibre tension.....	.....	.....	.....	3,000
Bending on extreme fibre compression.....	.....	.....	.....	10,000
Bending on extreme fibres of pins.....	25,000	.....	.....	.....
Shear: shop driven rivets and pins.....	12,000	.....	.....	.....
Shear: field driven rivets.....	10,000	.....	.....	.....
Shear on rolled steel shapes.....	12,000	.....	.....	.....
Shear plate girder webs; gross section.....	10,000	.....	.....	.....
Shear on brackets	.....	.....	.....	2,000
Bearing, shop driven rivets and pins.....	25,000	.....	.....	.....
Bearing, field rivets	20,000	.....	.....	.....

(b) The allowable compressive stresses per square inch shall be determined by the following formulæ:

$$\text{Steel} \ldots\ldots 16{,}000 - 70\frac{L}{R}$$

$$\text{Wrought iron} \ldots\ldots 12{,}000 - 60\frac{L}{R}$$

$$\text{Cast Iron} \ldots\ldots 10{,}000 - 60\frac{L}{R}$$

In the above formulæ:

L equals length in inches.

R equals least radius of gyration in inches.

(c) In no case shall the allowable compressive stress exceed that given in paragraph (a) of this section.

(d) For steel columns filled with, and encased in concrete extending at least three inches beyond the outer edge of the steel, where the steel is calculated to carry the entire live and dead load, the allowable stress per square inch shall be determined by the following formulæ:

$$18{,}000 - 70\frac{L}{R},$$

but shall not exceed 16,000 pounds.

(e) For steel columns filled with, but not encased in, concrete the steel shall be calculated to carry the entire live and dead load. In this case the above formulæ may be used, but the allowable stress shall not exceed 14,000 pounds.

(f) Stress due to eccentric loading shall be provided for in all compressive members.

(g) The length of rolled steel compressive members shall not exceed one hundred twenty times the least radius of gyration, but the limiting length of struts for wind bracing only may be one hundred fifty times the least radius of gyration. The limiting length for cast iron columns shall be seventy times the least radius of gyration.

(h) Cast iron columns shall not be used in buildings of greater height than twice the least width, or in buildings over 100 feet high.

542. **Live and Dead Loads—Stress.)** (a) Wherever the live and dead load stresses are of opposite character, only 70 per cent of the dead load stress shall be considered as effective in counteracting the live load stress.

(b) For stresses produced by wind forces combined with those from live and dead load, the unit stress may be increased fifty per cent. over those given above; but the section shall not be less than required if wind forces be neglected.

543. **Riveting—Tension.)** (a) In proportioning tension members the diameter of the rivet holes shall be taken one-eighth of an inch larger than the nominal diameter of the rivet.

(b) In proportioning rivets the nominal diameter of the rivet shall be used.

(c) Pin-connected riveted tension members shall have a net section through the pin-hole at least 25 per cent in excess of the net section of the body of the member and the net section back of the pin-hole, parallel with the axis of the member, shall not be less than the net section of the body of the member.

544. **Plate Girders — Flanges — Compression.)** (a) Plate girders shall be proportioned either by the moment of inertia of their net section, or by assuming that the flanges are concentrated at their centers of gravity and a unit stress used such that the extreme fibre stress does not exceed 16,000 pounds per square inch, in which case one-eighth of the gross section of the web, if properly spliced, may be used as flange section.

(b) The gross section of the compression flanges of plate girders shall not be less than the gross section of the tension flanges; nor shall the stress per square inch in the compression flange of any beam or girder of a longer length than 25 times the width exceed.

$$20{,}000 - 160\frac{L}{B}$$

In which formula

L equals unsupported distance and

B equals width of flange.

(c) The flanges of plate girders shall be connected to the web with a sufficient number of rivets to transfer the total shear at any point in a distance equal to the effective depth of the girder at that point combined with any load that is applied directly on the flanges.

(d) Webs of plate girders shall be provided with stiffeners over all bearing points, under all points of concentrated loading and elsewhere when required by good engineering practice.

Reinforced Concrete.

545. **Reinforced Concrete — Definition — Plans.)** The term "Reinforced Concrete" means any combination of metal imbedded in concrete to form a structure so that the two materials assist each other to sustain all the stresses imposed. Before a permit to erect any reinforced concrete structure is issued, complete plans and specifications shall be filed with the Commissioner of Buildings, showing all details of the construction, including detail of working joints, the size and position of all reinforced rods, stirrups or other forms of metal, and giving the composition and proportion of the concrete; provided, however, that permission to erect any reinforced concrete structure does not in any manner approve the construction until after tests have been made of the actual construction to the satisfaction of the Commissioner of Buildings.

546. **Ratio of Moduli of Elasticity—Adhesion—Bond.)** (a) The calculations for the strength of reinforced concrete shall be based on the assumed ultimate compressive strength per square inch designated by the letter "U" given in the table below for the mixture to be used.

(b) The ratio designated by the letter "R" of the modulus of elasticity of steel to that of the different grades of concrete shall be taken in accordance with the following table:

Mixture.	U	R
1 cement, 1 sand, 2 broken stone, gravel or slag	2,900	10
1 cement, 1½ sand, 3 broken stone, gravel or slag	2,400	12
1 cement, 2 sand, 4 broken stone, gravel or slag	2,000	15
1 cement, 2½ sand, 5 broken stone, gravel or slag	1,750	18
1 cement, 3 sand, 7 broken stone, gravel or slag	1,500	20

547. **Unit Stresses for Steel and Concrete.)** (a) The stresses in the concrete and the steel shall not exceed the following limits:

(b) Tensile stress in steel shall not exceed one-third of its elastic limits and shall not exceed 18,000 pounds per square inch.

(c) Shearing stress in steel shall not exceed 12,000 pounds per square inch.

(d) The compressive stress in steel shall not exceed the product of the compressive stress in the concrete multiplied by the elastic modulus of the steel and divided by the elastic modulus of the concrete.

(e) Direct compression in concrete shall be one-fifth of its ultimate strength. Bending in extreme fibre of concrete shall be thirty-five one-hundredths of the ultimate strength.

(f) Tension in concrete on diagonal plane shall be one-fiftieth of the ultimate compressive strength.

(g) For a concrete composed of one part of cement, two parts of sand and four parts of broken stone, the allowable unit stress for adhesion per square inch of surface of imbedment shall not exceed the following:

	Pounds Per Sq. Inch.
On plain round or square bars of structural steel	70
On plain round or square bars of high carbon steel	50
On plain flat bars, in which the ratio of the sides is not more than 2 to 1	50
On twisted bars when the twisting is not less than one complete twist in eight diameters	100

(h) For specially formed bars, the allowable unit stress for bond shall not exceed one-fourth of the ultimate bond strength of such bars without appreciable slip which shall be determined by tests made by the person, firm or corporation to the satisfaction of the Commissioner of Buildings, but provided that in no case shall such allowable unit stress exceed 100 pounds per square inch of the specially formed bars.

548. **Design for Slabs, Beams and Girders.)** Reinforced concrete slabs, beams and girders shall be designed in accordance with the following assumptions and requirements:

(a) The common theory of flexure shall be applied to beams and members resisting bending.

(b) The adhesion between the concrete and the steel shall be sufficient to make the two materials act together.

(c) The steel to take all the direct tensile stresses.

(d) The stress strain curve of concrete in compression is a straight line.

(e) The ratio of the moduli of elasticity of concrete to steel shall be as specified in the table in Section 546.

549. **Moments of External Forces.)** (a) Beams, girders, floor or roof slabs and joists shall be calculated as supported, or with fixed ends, or with partly fixed ends, in accordance with the actual end conditions, the number of spans and the design.

(b) When calculated for ends partly fixed for intermediate spans with an equally distributed load where the adjacent spans are of approximately equal lengths:

Bending moment at center of spans shall not be less than that expressed in the formula $\frac{WL^2}{12}$ for intermediate spans and $\frac{WL^2}{10}$ for end spans.

(c) The moment over supports shall not be less than the formula $\frac{WL^2}{18}$ and the sum of the moments over one support and at the center of span shall be taken not less than the formula $\frac{WL^2}{6}$.

In the formula hereinabove given "W" is the load per lineal foot and "L" the length of span in feet.

(d) In case of concentrated or special loads the calculations shall be based on the critical condition of loading.

(e) For fully supported slabs, the free opening plus the depth, for continuous slabs, the distance between centers of supports, is to be taken as the span.

(f) Where the vertical shear, measured on the section of a beam or girder between the centers of action of the horizontal stresses, exceeds one-fifth of the ultimate direct compressive stress per square inch, web reinforcement shall be supplied sufficient to carry the excess. The web reinforcement shall extend from top to bottom of beam, and loop or connect to the horizontal reinforcement. The horizontal reinforcement carrying the direct stresses shall not be considered as web reinforcement.

(g) In no case, however, shall the vertical shear, measured as stated above, exceed one-fifteenth of the ultimate compression strength of the concrete.

(h) For T beams the width of the stem only shall be used in calculating the above shear.

(i) When steel is used in the compression side of beams and girders, the rods shall be tied in accordance with requirements of vertical reinforced columns with stirrups connecting with the tension rods of the beams or girders.

(j) All reinforcing steel shall be accurately located in the forms and secured against displacement; and inspected by the representative of the architect or engineer in charge before any surrounding concrete be put in place. It shall be afterwards completely inclosed by the concrete, and such steel shall nowhere be nearer the surface of the concrete than 1½-inch for columns, 1¼ inch for beams and girders, and ½-inch, but not less than the diameter of the bar, for slabs.

(k) The longitudinal steel in beams and girders shall be so disposed that there shall be a thickness of concrete between the separate pieces of steel of not less than one and one-half times the maximum sectional dimension of the steel.

(l) For square slabs with two-way reinforcements the bending moment at the center of the slab shall not be less than that expressed in the formula $\frac{WL^2}{24}$ for intermediate spans, and $\frac{WL^2}{20}$ for end spans.

(m) The moment over supports shall not be less than the formula $\frac{WL^2}{36}$ and the sum of the moments over one support and at the center of the span shall be taken not less than the formula $\frac{WL^2}{12}$.

In which above formula "W" is the load per lineal foot and "L" the length of the span.

(n) For squares or rectangular slabs, the distribution of the loads in the two directions, shall be inversely as the cubes of the two dimensions.

(o) Exposed metal of any kind will not be considered a factor in the strength of any part of any concrete structure, and the plaster finish applied over the metal shall not be deemed sufficient protection unless applied of sufficient thickness and so secured as to meet the approval of the Commissioner of Buildings.

550. **Limiting Width of Flange in "T" Beams.)** (a) In the calculation of ribs, a portion of the floor slab may be assumed as acting in flexure in combination with the rib. The width of the slab so acting in flexure is to be governed by the shearing resistance between rib and slab, but limited to a width equal to one-third of the span length of the ribs between supports and also limited to a width of three-quarters of the distance from center to center between ribs.

(b) No part of the slab shall be considered as a portion of the rib, unless the slab and rib are cast at the same time.

(c) Where reinforced concrete girders support reinforced concrete beams, the portion of floor slab acting as flange to the girder must be reinforced with rods near the top, at right angles to the girder, to enable it to transmit local loads directly to the girder and not through the beams.

551. **Shrinkage and Thermal Stresses.)** Shrinkage and thermal stresses shall be provided for by introduction of steel.

552. **Reinforced Concrete Columns—Limit of Length—Per Cent of Reinforcement—Bending Moment in Columns—Tying Vertical Rods.)** (a) Reinforced concrete may be used for columns in which the concrete shall not be leaner than a:1:2:4 mixture and in which the ratio of length to least side or diameter does not exceed twelve, but in no case shall the cross section of the column be less than 64 square inches. Longitudinal reinforcing rods must be tied together to effectively resist outward flexure at intervals of not more than twelve times least diameter of rod and not more than 18 inches. When compression rods are not required, reinforcing rods shall be used, equivalent to not less than one-half of one per cent (.005) of the cross sectional area of the column; provided, however, that the total sectional area of the reinforcing steel shall not be less than one square inch, and that no rod or bar be of smaller diameter or least dimensions than one-half inch. The area of reinforcing compression rods shall be limited to three per cent. of cross sectional area of the column. Vertical reinforcing rods shall extend upward or downward into the column, above or below, lapping the reinforcement above or below enough to develop the stress in rod by the allowable unit for adhesion. When beams or girders are made monolithic with or rigidly attached to reinforced concrete columns, the latter shall be designed to resist a bending moment equal to the greatest possible unbalanced moment in the beams or girders at the columns, in addition to the direct loads for which the columns are designed.

(b) When the reinforcement consists of vertical bars and spiral hooping, the concrete may be stressed to one-fourth of its ultimate strength as given in Section 546, provided, that the amount of vertical reinforcement be not less than the amount of the spiral reinforcement, nor greater than eight per cent. of the area within the hooping; that the percentage of spiral hooping be not less than one-half of one per cent. nor greater than one and one-half per cent.; that the pitch of the spiral hooping be uniform and not greater than one-tenth of the diameter of the column, nor greater than three inches; that the spiral be secured to the verticals at every intersection in such a manner as to insure the maintaining of its form and position, that the verticals be spaced so that their distance apart, measured on the circumference be not greater than nine inches, nor one-eighth the circumference of the column within the hooping. In such columns, the action of the hooping may be assumed to increase the resistance of the concrete equivalent to two and one-half times the amount of the spiral hooping figured as vertical reinforcement. No part of the concrete outside of the hooping shall be considered as a part of the effective column section.

553. **Structural Steel Columns.)** When the vertical reinforcement consists of a structural steel column of box shape, with lattice or battenplates of such a form as to permit its being filled with concrete, the concrete may be stressed to one-fourth of its ultimate strength as given in table in Section 546, provided that no shape of less than one square inch section be used and that the spacing of the lacing or battens be not greater than the least width of the columns.

554. **Curtain Walls in Skeleton Construction Buildings.)** Buildings having a complete skeleton construction of steel or of reinforced concrete construction, or a combination of both, may have exterior walls of reinforced concrete eight inches thick; provided, however, that such walls shall support only their own weight and that such walls shall have steel reinforcement of not less than three-tenths of one per cent in each direction, vertically and horizontally, the rods spaced not more than twelve-inch centers and wired to each other at each intersection. All bars shall be lapped for a length sufficient to develop their full stress for the allowable unit stress for adhesion. Additional bars shall be set around openings, the verticals wired to the nearest horizontal bars, and the horizontal bars at top and bottom of openings shall be wired to the nearest vertical bars. The steel rods shall be combined with the concrete and placed where the combination will develop the greatest strength, and the rods shall be staggered or placed and secured so as to resist a pressure of thirty pounds per square foot, either from the exterior or from the interior on each and every square foot of each wall panel.

555. **Bending and Elongation of Steel.)** The bending and elongation of steel used in reinforced concrete construction shall conform to the following requirements: (a) Steel having a diameter of three-fourths of an inch or less shall be capable of bending cold ninety degrees over a diameter equal to twice the thickness of the piece without fracture; steel over three-fourths inch in diameter shall be capable of bending cold to ninety degrees over a diameter equal to three times the diameter of the piece.

(b) The material of reinforcement shall be such form that it will not elongate under working stress to exceed one fifteen-hundredth.

(c) Reinforcing steel used in reinforcing concrete construction shall not be painted, but shall be free from all mill scale and loose rust.

556. **Cement Tests.)** (a) Only Portland cement shall be used in reinforced concrete construction. All cement shall be tested in car load lots when delivered, or in quantities equal to the same. Cement failing to meet the requirements of accelerated test shall be rejected.

(b) Pats of neat cement must be allowed to harden twenty-four hours in moist air, and then be submitted to the accelerated test as follows: A pat is exposed in any convenient way in an atmosphere of steam, and above boiling water, in a loosely closed vessel for three hours, after which before the pat cools, it is placed in the boiling water for five additional hours. To pass this test satisfactorily, the pat shall remain firm and hard, and show no signs of cracking, distortion or disintegration.

(c) Portland cement when tested shall have a minimum tensile strength as follows: Neat cement after one day in moist air shall develop a tensile strength of at least 200 pounds per square inch; after one day in air and six days in water shall develop a tensile strength of at least 500 pounds per square inch, and after one day in air and twenty-seven days in water, shall develop a tensile strength of at least 600 pounds per square inch. Cement and sand tests composed of one part of cement and three parts of sand shall after one day in air and six days in water, develop a tensile strength of at least 175 pounds per square inch; and after one day in air and twenty-seven days in water, shall develop a tensile strength of at least 240 pounds per square inch.

(d) A certificate that the cement used has been tested and has met the requirements of this section and that the tests have been made in accordance with the standard methods prescribed by the American Society for Testing Materials, on pages 149 to 164, both inclusive, of the proceedings of the Eleventh Annual Meeting of the American Society for Testing Materials, adopted August 15, 1908, shall be furnished by the architect or engineer in charge to the Commissioner of Buildings.

557. **Sand.)** The sand to be used for concrete shall be clean, hard, coarse sand, of the grade known as torpedo sand, and free from loam or dirt, not less than 45 per centum shall be returned on a screen of 400 mesh to the square inch.

558. **Stone.)** The stone to be used in concrete shall be clean crushed hard stone or clean crushed blast furnace slag or gravel of a size to pass through a one-inch square mesh. If limestone or slag is used, it shall be screened to remove all dust; if gravel is used, it shall be thoroughly washed. Stone shall be drenched immediately before using. If slag is used, it shall be of such character that when made into concrete the concrete will develop a crushing strength equal to that specified for stone or gravel concrete.

559. **Mixing.)** All concrete shall be mixed in a mechanical mixer except when limited quantities are required, or when the conditions of the work make hand mixing preferable; hand mixing to be done only when approved by the Commissioner of Buildings. In all mixing, the separate ingredients shall be measured and shall be thoroughly mixed and must be uniform in color, appearance and consistency before placing.

560. **Placing Concrete.)** In filling in concrete around reinforcing steel, the concrete must be worked continuously with suitable tools, as it is put in place. Filling the forms completely and puddling afterward will not be permitted. In placing the concrete, the work shall be so laid out that partly set concrete will not be subjected to shocks from men wheeling or handling material over it.

561. **Concrete Placed in Freezing Weather.)** When concreting is carried on in freezing weather, the material must be heated, and such provisions made that the concrete can be put in place without freezing. The use of frozen, lumpy sand, or stone depending on hot water used in mixing to thaw it out will not be permitted. All reinforced concrete shall be kept at a temperature above freezing for at least forty-eight hours after being put in place. All forms under concrete placed in freezing weather shall remain until all evidences of frost are absent from the concrete and the natural hardening of the concrete has proceeded to the point of safety.

562. **Concrete Placed in Warm Weather.)** Concrete laid in warm weather shall be drenched with water twice daily, Sunday included, during the first week after being put in place.

563. **Cement Finish.)** Cement finish added to the top of slabs, beams, or girders, shall not be calculated in the strength of a member unless laid integrally with the rough concrete. No greater unit stress shall

be allowed on such cement finish than on the rough concrete.

564. **Fireproof Concrete Construction.)** Reinforced concrete construction will be accepted for fireproof buildings if designed as prescribed in this paragraph. The aggregate for such concrete shall be clean, broken stone or clean crushed blast furnace slag, or clean screened gravel, together with clean, coarse sand of the grade known as torpedo sand; stone, slag or gravel shall be of a size to pass through a screen of three-quarter inch mesh. The minimum thickness of concrete surrounding the reinforcing members of reinforced concrete beams and girders shall be two inches on the botton, and one and one-half inches on the sides of said beams and girders. The minimum thickness of concrete under slab rods shall be one inch; and all reinforcement in columns shall have a minimum protection of two inches of concrete except as hereinafter provided, if a supplementary metal fabric is placed in the concrete surrounding the reinforcing, simply for holding the concrete, the thickness of concrete under the reinforcing may be reduced by one-half inch, then such fabric shall not be considered as reinforcing metal.

565. **Removal of Forms.)** In no case shall the props and shores used in reinforced concrete construction be removed from under floors and roofs in less than two weeks, except as is provided herein. Column forms shall not be removed in less than four days. The centering from bottom of slabs and sides of beams and girders may be removed after the concrete has set for one week, if the floor has obtained sufficient hardness to sustain the dead weight of the said floor. No load or weight shall be placed on any portion of the construction until the concrete has fully set and the centers have been removed.

566. **Tests.)** The contractor for the reinforced concrete construction shall make load tests on any portion of the work within a reasonable time after erection, as may be required by the Commissioner of Buildings. Such tests must be made under the direction of the Commissioner of Buildings in his presence or in the presence of his representative, and must show that the construction will sustain a load twice the sum of the live and dead loads for which it was designed, without any sign of failure. The construction may be considered as part of the test load. Each test load shall cover two or more panels and shall remain in place at least twenty-four hours. The deflection under the full test load at the expiration of twenty-four hours shall not exceed one eight-hundredth of the span. These tests shall be considered as tests of workmanship only.

567. **Reinforced Terra Cotta Hollow Tile.)** (a) The term reinforced hollow tile is hereby defined to mean a system of hollow burned clay tile in combination with reinforced concrete, in which combination the hollow tile may be used to resist compressive and shearing stresses subject to the following provisions:

The provisions relating to reinforced concrete construction shall hold as far as applicable to this system.

All tile to be hard burned terra cotta tile of uniform quality, free from shrinkage cracks, with true beds and having an ultimate compressive strength of not less than 4,000 pounds per square inch of net area of surface tested.

The following stresses and values shall not be exceeded: Extreme fibre stress (compressive) on hollow tile, 500 pounds per square inch.

Shearing stress on hollow tile, 200 pounds per square inch.

Adhesion between tile and 1:2:4 concrete to 1:3 cement mortar, 40 pounds per square inch.

Ratio of modulus of elasticity of steel to that of tile with cement mortar joints, 10.

(b) **Special Provisions as to Workmanship in Reinforced Hollow Tile Construction.)** The hollow tile shall be thoroughly soaked with water at the time concrete is poured and be kept drenched for at least thirty-six hours afterwards. The joints between tiles shall be staggered, buttered and slushed full of mortar consisting of one (1) part of Portland cement and three (3) parts of clean, sharp sand, thoroughly mixed.

(c) **Terra Cotta Tile Columns.)** Columns of solid terra cotta or of hollow terra cotta in which the sectional area of the open holes in each block shall not exceed twenty (20) per cent of the gross sectional area of such block, may be used for structural purposes provided the height of such column shall not exceed twelve times the least dimension.

The allowable stress shall not exceed 350 pounds per square inch and shall be subject to the reduction formula given in Section 553 in paragraph f.

All terra cotta tile used for construction of columns shall be hard burned terra cotta tile of uniform quality, free from shrinkage cracks, with true beds and having ultimate compressive strength of not less than 6,000 pounds per square inch of net area of cross section of samples tested.

Mortar used in setting terra cotta tile walls and columns to be composed of one (1) part Portland cement and three (3) parts clean, sharp sand, thoroughly mixed.

(d) **Special Provisions as to Workmanship in Tile Column Construction.)** All terra cotta tile must be thoroughly wet before using and when used in columns must be set on end with the voids running vertically and directly over each other, and with the webs in direct line of pressure.

All vertical joints must stagger and terra cotta blocks must be of proper dimensions to meet this condition as no broken tile will be allowed.

All work to be set plumb, with uniform horizontal joints, thickness to average three-eighths (3-8) of an inch. The minimum time which shall elapse between the finishing of the work and before any load is placed thereon shall be not less than seven days.

(e) **Terra Cotta Tile Walls.)** Hollow tile may be used for building primary bearing walls, which are defined as walls that may be used to receive directly the loads from floors or roofs in addition to their acting as partition walls, provided the proportion between thickness of wall and free height between the floors does not exceed fifteen (15) and the load including the weight of the construction does not exceed three hundred and fifty (350) pounds per square inch of net sectional area of tile, and shall be of the thickness specified by this chapter for brick walls. Hollow terra cotta tile may be used for exterior walls, but when so used the thickness and height of the work must conform to the dimensions required for brick walls in this chapter, but must in no case exceed four stories in height in any building. The thickness of walls shall be calculated as the outside dimensions of the tile and each tile shall be full thickness of wall. The thickness of the plastering is not to be included as a part of the thickness of the wall. Walls having a thickness of 4 inches may be used when the height does not exceed five (5) feet. The quality of the tile and mortar and special provisions as to workmanship as specified for terra cotta columns shall apply to terra cotta tile walls.

(f) **Terra Cotta Grain Bin Construction.)** Fireproof storage bin, grain elevators and

grain warehouses may be built in cylindrical form with terra cotta tile of such height, diameter and thickness as is allowed by safe engineering practices, provided that the material shall not be stressed in excess of the limits prescribed in this chapter for walls and columns.

568. **Cinder Concrete.)** (a) Cinder concrete construction may be used for all buildings in which fireproof construction is mandatory by this chapter, or where ordinary construction, mill construction or slow-burning construction may be used.

(b) Only clean, thoroughly burnt, steam boiler cinders, free from matter other than cinders may be used. The cinders used shall be of such size that they will pass through a one-inch square mesh. Cinder concrete piers or walls shall not be permitted to carry loads and shall not be given credit therefor.

(c) The ultimate compressive strength per square inch of cinder concrete shall be taken as not exceeding seven hundred pounds. The ratio of the modulus of elasticity of steel divided by the modulus of elasticity of cinder concrete shall be taken as thirty.

(d) There shall not be less than one part of Portland cement to seven parts of cinders and sand of the grade known as torpedo sand in cinder concrete. All other special requirements and methods of calculation for reinforced concrete as required in this chapter shall modify and regulate the use of cinder concrete in buildings.

(e) All steel and all metal pipe and conduits enclosed in cinder concrete shall be protected by a coating of cement grout or plastered with good lime mortar before the cinder concrete is placed.

(f) For fireproof construction, the minimum thickness of cinder concrete covering on structural metal shall be the same as required for brick or concrete covering for fireproof buildings by this chapter. In slow-burning or mill construction buildings, the minimum thickness of cinder concrete covering on structural metal shall be three inches on columns and two inches on beams, girders and other structural steel or iron members.

(g) Wherever cinder concrete is used for the covering of columns, beams, girders or other structural steel members of a building the cinder concrete covering shall have metal binders, or wire fabric, imbedded in and around said columns, beams, girders or other structural steel members. If wire is used for said metal binders, it shall not be smaller than No. 8 gauge wire and shall be spaced not less than sixteen inches apart along the length of the steel member covered.

(h) Where cinder concrete construction is used for a building which, by this chapter, is required to be of fireproof construction, all parts that carry weights or resist strains, shall be made entirely of incombustible material, and all metallic structural members shall be protected against the effects of fire by cinder concrete proportioned, mixed, applied and secured as herein described.

(i) All other parts of a building of cinder concrete construction, built where fireproof construction is mandatory by this chapter, shall be built and made of the material required by this chapter for buildings of fireproof construction; provided, however, that cinder concrete as described herein, and of the same thickness elsewhere specified, may be used for all protective covering of structural metal, after such metal has been protected by a coating of cement grout or plastered with good lime mortar, as required by this chapter.

Skeleton Construction.

569. **Skeleton Construction.)** (a) The term "Skeleton Construction" shall apply to all buildings wherein all external and internal loads and stresses are transmitted from the top of the building to the foundations by a skeleton or framework of metal or reinforced concrete.

(b) In metal frame skeleton construction the beams and girders shall be riveted to each other at their respective junction points. If columns made of rolled iron or steel are used, their different parts shall be riveted to each other, and the beams and girders shall have riveted connections to unite them with the columns. If cast iron columns are used, each successive column shall be bolted to the one below it by at least four bolts not less than ¾ inch in diameter, and the beams and girders shall be bolted to the columns. Bolt holes in flanges for connection from column to column shall be drilled. At each line of floor or roof beams, lateral connections between the ends of the beams and girders shall be made in such manner as to rigidly connect the beams and girders with each other in the direction of their length.

(c) All steel trusses shall be riveted and the steel work in buildings more than 100 feet high and in a building whose height exceeds twice its width shall be riveted.

(d) Wherever it is found impossible to rivet connections as herein described and such connections are bolted, cold rolled or turned bolts of exact fit and diameter in reamed holes may be used in place of rivets with the same allowable stresses as field driven rivets.

(e) All structural members which are temporarily bolted together shall be well bolted in every alternate hole.

(f) After the bases or base plates and columns have been set in place, both shall be protected by a covering of cement concrete applied direct to the metal, measuring not less than two and one-half inches thick from the extreme projection of the metal, filled solid into all spaces, and forming a continuous concrete mass from the grillage or other foundations to an elevation six feet above the floor level nearest the column base plate or column stool.

(g) All metal shall be clean and shall be free from loose rust and scale, and all metal except that to be embedded in concrete shall be protected with at least two coats of metal protecting paint.

(h) All structural details and workmanship shall be in accordance with accepted engineering practice.

(i) All trusses shall be held rigidly in position, both temporarily and permanently by efficient lateral and sway bracing.

Miscellaneous Provisions.

570. **Porches—Verandas—Porticos—Construction of Inside Fire Limits.)** (a) The enclosing walls of porches, verandas, or porticos shall be of incombustible material on buildings inside the fire limits, except that where such porches, verandas, or porticos constitute part of a storm house or of a storm door enclosure, they may be of combustible material, providing, that they be not more than twelve feet high, nor occupy a greater frontage than two feet more than the width of the inner doors protected by such storm enclosure.

(b) On buildings more than three stories in height, porches hereafter erected, if of combustible material, shall not exceed one story in height. Where porches of incombustible material are continuous and extend fifty feet or more across the rear of buildings, there shall be a partition of incombustible material separating each fifty feet of porch from the adjacent porch.

571. **Tanks on Roofs—Permits—Fees.)** It shall be unlawful for any person, firm or

corporation to construct, maintain or allow, or permit to remain in or upon the roof of any building in the city, any tank of a larger capacity than four hundred gallons, unless such tank shall rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron girders set on steel plates which rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron or steel construction. No tank of a capacity exceeding four hundred gallons shall be constructed in or upon any building without first submitting for the approval of the Commissioner of Buildings a complete set of plans, showing the construction in detail of the supports and foundations of such tank. If such plans shall be satisfactory to the Commissioner of Buildings, they shall be approved by him. The owner or his agent or the contractor erecting such tank shall, before proceeding with the erection of such tank, procure from the Department of Buildings a permit for the sub-structure work, for which permit a fee of five dollars shall be charged.

572. **Door and Window Openings, When Protected in Buildings of Classes I, II, IV, V, VII and VIII—Iron Doors—Wired Glass Set in Metal Frames.)** (a) Where the distance from door to window openings in buildings of Classes I, II, IV, V, VII and VIII is less than thirty (30) feet from the opposite side of the established alley line and where the windows and doors of two or more areas of the same building which is required to be separated by dividing walls by this chapter, are on a court, every such window and door, distant less than thirty feet from another window or door of another such area and where also the doors and window openings are within fifteen (15) feet of an inside lot line, such openings shall be provided with windows and doors constructed of wire glass set in metal frames and sash; provided, further, that doors may be automatic rolling steel shutters or steel plate doors or metal-clad wood doors, and further provided that at least one of the first or ground floor doors must be a swinging door.

(b) Where iron doors are used to fulfill the requirements of this section they shall be made of sheet iron or steel, of not less than No. 14 U. S. gauge metal, and shall lap the wall at least one-half inch all around the opening, and the bottom shall fit the sill closely where it is not practicable to lap it. The frames and crossbars shall be made of one and one-half by one and one-half by one-fourth inch angles and in no case shall there be less than two crossbars, and where the doors are over six feet high, such crossbars shall be spaced not more than two feet apart. Lever bars shall be made of one and one-half by three-eighths inch iron, extending at least one-third of the distance across the opposite leaf. The number and spacing of such lever bars shall be the same as the crossbars. Where hinges are used they shall be made of two by one-fourth inch iron, extending at least three-fourths of the way across the door. The number and spacing of such hinges shall be the same as is required for the crossbars. Pin bolt or eyes shall be one-half inch round and shall be securely fastened to the building.

(c) Where metal frames and wired glass are used to fulfill the requirements of this section, the glazed portion of the frames and sash shall be set with fire-resisting glass such as is elsewhere herein defined. The unsupported area of the glass shall be in neither width nor length greater than forty-eight inches or exceed seven hundred and twenty (720) square inches in any one pane of glass. The glass must be supported by frames and sashes. The wired glass shall be retained by the structural part of the frame or sash independently of material used for waterproof purposes and only non-inflammable material shall be used in setting glass in the sash. Frames shall be of such form as to be retained by the walls either with flanges of at least one inch in width or by hooks of proper length securely driven into the wall or by means of extending wings flush with the brickwork and securely spiked to the wall. Frames shall be made of galvanized iron of not less than No. 24 gauge metal, and of a quality soft enough to permit all necessary bending without breaking, or they may also be constructed of not less than 20-ounce copper, or other metal of equal strength and durability and which will not melt at a lower temperature than copper. All joints shall be made with interlocking seams. They shall be securely riveted together, and in no case, shall solder be used. Grooves and rabbets shall be at least three-quarters of an ich in depth and the actual bearing of the glass shall be at least five-eighths of an inch. The head of the frame shall be closed at the top and the piece forming this closure shall be securely fastened to each side at all points. The sill shall be filled with concrete or other incombustible material. Movable sash shall have stiles and rails of the thickness and width of at least one and three-quarters inches and shall be securely fastened together at each corner and so constructed that they will correspond in construction with the frame at the point of contact.

(d) Lifting or sliding sash shall be counterweighted so as to balance. The sash weights shall be properly separated by parting strips in the boxes containing them, and shall be accessible through the jambs of the frame. Such sash shall be provided with metallic sash chain or cable and smooth running sash pulleys securely riveted or bolted in place. The sash chain or cable shall be of sufficient strength to withstand severe heat without parting, and be thoroughly protected against moisture and corrosion. The sash shall be fitted into the frame with suitable stops and parting beads of metal. Sash shall be removable. Meeting rails of the sash shall be so constructed as to prevent the passage of heat and flame. The sash shall be equipped with one or more substantial sash locks securely riveted or bolted in place.

(e) Horizontally pivoted sash shall be riveted above the center on steel pivots at least three-eighths inch in diameter. Pivots shall work in brass eye plates securely riveted in place. Frames shall be reinforced where the pivots enter by riveting on one-eighth inch iron strips, so drilled as to receive the pivots. Such sash must be provided with suitable stops and an effective attachment for holding them open or closed. Such sash shall be provided with a substantial gravity lock or latch at top and bottom which will be positive in action. Where the lower sash is stationary or where two pivoted sash are used the transom bar dividing the upper from the lower sash shall be so constructed that it will not warp or bulge materially under heat or rapid cooling. Where rails and transom bars are used they shall be made so as not to be easily affected by rust and so as to afford ample weatherproof qualities.

(f) Vertically pivoted sash shall comply generally with the requirements for horizontally pivoted sash. If the entire window is pivoted in one sash, such sash must be constructed in such manner as to afford stiffness, and in such manner as to prevent warping under heat.

(g) Hinge sash or casement windows must be hinged with heavy brass hinges and a substantial brass latch or lock securely bolted in place. Such sash shall be constructed so as to fit the frame closely and afford ample weatherproof qualities at all points. They shall be provided with

stops and fastenings necessary to prevent warping under heat.

(h) Where the area of wall openings is in excess of 5 by 9 feet, the metal frames containing the sash or glass must be reinforced at every point of division by not less than five-inch "I" beams securely fastened into the brickwork, proper allowance being made for expansion of the beams when heated. "I" beams shall be protected on the flanges with at least two inches of tile, concrete, or other material approved by the Commissioner of Buildings, and next to the web with at least two and one-half inches of such material, which thickness shall be increased on large beams. Metal frames shall be securely attached to the reinforcing members.

(i) Electro-glazed prism glass may be used in lieu of wired glass, when approved by the Commissioner of Buildings as to material and construction of same, providing the frames and sash of same comply with the requirements of this section for wired glass window frames and sash.

(j) This section shall not apply to frame buildings nor to buildings outside the fire limits twenty-eight hundred square feet or less in area, nor to buildings of Class I, one story in height, nor to buildings of Class II not more than two stories in height, nor to store windows in the first story, where the same are located on an alley and not more than sixteen feet from the street.

573. **Dividing Walls and Iron Doors—Openings Inserted.)** (a) Wherever openings are to be inserted in dividing walls, as before described, or in dividing walls between non-fireproof and fireproof buildings, or parts of either of such buildings, they shall be made as follows:

(b) Such doors may be either sliding doors or swinging doors, and shall be so constructed, installed and maintained that they can be easily opened or closed from either side at all times by any person; provided, however, rolling steel shutters may be used when such openings are not used as exits.

(c) Every such door shall be equipped with a device containing a fusible link or other releasing arrangement of equal efficiency, approved by the Commissioner of Buildings. There shall be one of these immediately above the door opening and one above the opening near the ceiling. Where the ceiling is less than three feet above the door opening, the last mentioned fusible link or releasing device may be omitted, if the doors are so arranged that the operation of any one of the thermostats, or other releasing devices, will result in the closing of the doors on both sides of the walls. Fusible links, or other approved substitute, shall be made so that they will fuse or operate when subjected to a heat of 160 to 165 degrees Fahrenheit. If said doors are of steel plate, the plate or plates shall be of No. 12 U. S. gauge or greater thickness, with a continuous two by two by three-eighths inch angle iron frame extending all around the same and two by two by three-eighths inch panel bars not exceeding twenty-four inches apart, riveted to the plate of the door with not less than three-eighths inch rivets spaced four inches to six inches between centers. Pairs of swinging doors shall be so constructed that when the doors are closed, they will be of strength equal to that of a single door, and shall be so arranged that they will operate automatically. All doors shall be hung on wall frames of four by three by three-eighths inch angle iron or of four by three-eighths inch bar iron stiffened by one and one-half by one and one-half by one-fourth inch angles riveted on the back and fitting snugly to the wall. The frame shall be fastened together by three-fourths inch bolts extending through the wall, such bolts being not more than two feet apart. All doors to be made to fit closely to the wall frame on all sides. Lintels of door openings shall be made of brick, iron or concrete.

(d) Swinging iron doors shall swing on three wrought iron hinges made of two by three-eighths inch bar iron and shall be secured by at least three lever bars of one and one-half by three-eighths inch iron, working together and so arranged as to be operated on either side of the door.

(e) Sliding iron doors shall slide in channels at the top and bottom; bottom channels shall be formed by two angles two and one-half by three-eighths inch and one and one-half by one-fourth inch; top channels to be formed by two angles two by three-eighths inch and one and one-half by one-fourth inch; channels shall be securely riveted or bolted through the wall frame and where they extend beyond the wall frame shall be firmly bolted to the wall by expansion bolts. Track shall be without incline, of one-half by one-half inch iron securely riveted on the upper side of the angle iron channel. Hangers shall be of the anti-friction pattern and securely fastened to the door plate by at least four one-half inch bolts. Wheels shall be of cast iron three-fourths by four and one-half inches.

(f) Sills between iron doors shall be of one-fourth inch iron or steel with edges securely fastened to one and one-half by one and one-half by one-fourth inch angle iron or heavier, on the inner side of the wall frame. Where adjoining floors are of concrete construction, sill plates may be omitted.

(g) When tin-clad doors are used they shall be made of three thicknesses of thirteen-sixteenths inch seasoned, non-resinous wood, of good sound quality, free from sap and large or loose knots, tongued and grooved, dressed on both sides and not exceeding eight inches in width. The outside layers shall be vertical, the inside layer shall be horizontal; layers shall be securely fastened together by wrought iron clinch nails driven in flush and clinched so as to leave smooth surfaces. The woodwork shall be thoroughly covered with terne plate tin of size fourteen by twenty inches, weighing not less than one hundred and thirteen pounds per box of one hundred and twelve sheets; all joints shall be locked one-half inch and nailed under seams, except on edges of door; vertical joints shall be double locked, horizontal joints single locked. Nails used to fasten tin shall be No. 13 gauge, flat head, full barbed wire, two inches long.

(h) Swinging tin-clad doors shall have three-eighths by two and one-half inch wrought iron hinges bolted to doors with four three-eighth inch bolts. Doors in excess of seven feet in height shall be provided with three hinges and have wrought iron wall eyes built in wall, or riveted to wall frame, or bolted through wall with three-fourth inch bolts. They shall have at least three level bars of one and one-half by three-eighths inch iron working together; the latch shall be placed so it can be operated from either side of the door and provided with proper keepers bolted through the door, with the spring to insure latching; catches shall be made of one-half inch wrought iron securely bolted to wall or wall frame.

(i) Sliding tin-clad doors shall have tracks inclined three-fourths inch to the foot, made of three and one-half by three-eighths inch rolled steel, or round bars, or round pipes of equal strength, securely bolted through wall with three-fourths inch bolts. Hangers shall be made of three-eighths by three and one-half inch wrought

iron attached by not less than one-inch bolts. Wheels shall be of malleable or wrought iron with not less than one and one-half inches bearing on axle. Doors over six feet wide shall have three hangers and shall be provided with necessary binders, chafing strips, bumpers and bumper shoes.

(j) Sills between tin-clad doors shall be of one-fourth inch iron or steel riveted to a three and one-half by five by three-eighths inch angle iron on each side of the wall; angle irons to be fastened together through the wall by three-fourths inch bolts spaced not to exceed eighteen inches apart; provided, that where adjoining floors are of concrete construction, sill plates may be omitted.

(k) Rolling steel doors used as dividing wall doors shall be made either of wooden slats covered with steel or bronze, or of number 20 U. S. gauge painted steel, or of number 24 U. S. gauge galvanized steel. The edges of such doors shall run in steel channels not less than one and one-half inches deep, and three-sixteenths of an inch in thickness.

(l) Such doors shall be hung on winding shafts and helical springs of sufficient strength to counterbalance the door at any position, and shall be equipped with a device to hold the doors in a closed position if the spring is destroyed. The head of the door opening shall have baffle plates of number 12 U. S. gauge steel, which shall be reinforced around the edges by one and one-half inch angles, to act as fire and smoke stops. The openings for such doors shall have steel frames and sills as herein required for steel swinging doors.

574. **Metal or Reinforced Concrete Chimneys in Fireproof Buildings—Air Space.)** (a) Internal chimneys of rolled steel or iron may be built in buildings of fireproof construction, provided that the rolled steel shall be not less than three-eighths inch in thickness, except that the upper fifty feet of such chimney may be one-quarter of an inch in thickness, riveted in every joint, or of cast iron, providing same shall not be less than three-fourths inch in thickness and jointed by bell and spigot joints or flanged bolted joints. All joints in cast iron work shall be filled and pointed with fire clay. Such metal internal chimneys shall be securely and firmly anchored to the framing of such fireproof building at each floor line and at the roof. The lower part of each such chimney shall be lined with insulating lining for a height herein required for the respective area by Section 645 of this Chapter. The insulating lining shall be one of the linings described in Section 580 of this Chapter.

(b) Reinforced concrete not less than four inches in thickness may be used on the interior of fireproof buildings, provided the requirements for reinforced concrete and for reinforced concrete stacks elsewhere required by this Chapter shall be complied with.

(c) Internal metal or re-inforced concrete stacks on fireproof buildings shall be surrounded by continuous air space from the lowest story through the roof not less than four inches across at any point, and said air space shall be surrounded by brick, hollow tile, or reinforced concrete. No structural metal in such air space shall be without such fireproof covering.

575. **Reinforced Concrete Chimneys — How Built.)** Reinforced concrete chimneys in which the temperature of the gases is intended to exceed 750 degrees Fahrenheit, shall be lined with fire brick or magnesia or asbestos insulating lining for the height and in the manner elsewhere required by this Chapter. If the insulating is stopped anywhere below the top of a reinforced concrete chimney or if the cross section of such a chimney is changed, then the reinforcing shall be increased at such points sufficiently to prevent the formation of temperature cracks.

576. **Tenement and Apartment House Boiler Chimneys.)** Chimneys for the heating apparatus of tenement and apartment houses shall not be considered as flues used for domestic purposes.

577. **Height of Chimneys Above Roof.)** (a) The height of all chimneys and flues of stoves used for domestic purposes or open fireplaces shall be not less than five feet higher than the highest point of the roof of the building of which they are a part.

(b) The height of all chimneys and flues above the highest portion of the roof of which they are a part, where such chimneys or flues are used for other than domestic purposes or for open fireplaces, shall be determined by dividing the greatest diameter in inches by four, and the quotient thereby obtained in terms of feet, with five feet added, shall be the minimum height from the tops of such chimneys and flues above the highest portion of roof of the building. In no case shall the height of any chimney or flue be less than five feet above the roof of the building of which it is a part.

(c) The sum of the horizontal distance of any wood tank, pent house or roof house, on the same building of which any chimney shall be a part, and the vertical distance of top of such wood tank, pent house, or roof house, on the same building to a horizontal plane passed through the top of the chimney shall not be less than one and one-half times the required height of the top of the chimney above the roof. The tops of chimneys within a radius of twenty-five feet of any wood tank, pent house, or roof house, on the same building of which such chimney shall be a part shall be at least as high as the top of said wood tank, pent house, or roof house. The tops of chimneys on ridge roofs shall be not less than three feet above the ridge.

578. **Insulating Cavities — Where Required.)** All flues having a greater area than four hundred square inches shall be lined on the inside with an insulating material, which lining shall start at least two feet below the smoke inlet and shall extend upwards for at least ten times the diameter of the flue, or if said flue is not circular or square in cross section for ten times the average diameter, when the flues are of brick, stone or concrete, said insulating lining shall be fire clay brick or fire clay blocks, and if such bricks or blocks are four inches or more in thickness, they may be considered as a portion of the thickness required for the surrounding walls. The walls surrounding chimneys having an area greater than four hundred square inches shall have an insulating cavity not less than three inches wide surrounding the inner four inches of fire brick or fire clay blocks, for not less than the height required above for insulating lining and said inner core shall be built independent of the surrounding brick work and shall be free to expand or contract.

579. **Metal Chimneys in Buildings of Ordinary Slow-Burning or Mill Construction.)** Interior stacks or smoke flues of metal shall not be used in buildings of ordinary or slow burning or mill construction, unless they are surrounded by self-supporting brick or re-inforced concrete walls of the thickness herein required for flues of the respective area; provided, however, that if an interior smoke pipe of steel of not less than three-eighths inch in thickness riveted in every joint, or an interior smoke pipe of

cast iron not less than five-eighths inch in thickness is used, then the brick work required inside of the insulating cavity of a stack may be omitted, but such metal linings shall be lined with such insulating material for the height herein elsewhere required for stacks. If a chimney or stack is not a part of the walls of such a building, it shall be designed as an isolated chimney as required by Section 583 of this Chapter.

580. **Insulating Material for Metal Chimneys and Metal Stacks.)** (a) Fire clay brick or fire clay blocks may be used for the insulating lining of metal chimneys and stacks but not of a lesser thickness than two inches. The material shall be increased in thickness or supported on structural steel ledges and the material shall be stressed not to exceed the safe limits of stress elsewhere herein fixed for the material, or metal chimneys and metal stacks may be lined with blocks of magnesia insulation or with fused asbestos board insulation, or metal stacks or chimneys may be lined with any other insulating material tested and approved by the Commissioner of Buildings.

(b) Magnesia block insulation shall contain not less than 45 per cent of magnesia and 50 per cent asbestos fibre formed into blocks not less than 1½ inches in thickness by hydraulic pressure. After said magnesia blocks have been set, they and all metal bands and ties exposed with the flue shall be plastered with cement not less than one-half inch in thickness on one and one-half inch blocks, and one-fourth inch in thickness on one and three-fourths inch and thicker blocks.

(c) Fused asbestos board shall be made of alternate flat and corrugated sheets of asbestos board, cemented together and fused under a heat of not less than 1,000 degrees Fahrenheit to a minimum thickness of 1¼ inches. After said fused asbestos boards have been set into the flues, they and all exposed metal bands or ties shall be pointed with cement.

(d) Such magnesia blocks, fused asbestos boards, pointing cement and any other insulating material approved by the Commissioner of Buildings shall resist the disintegrating, dissolving, or diminishing action of moist steam and the acid and gaseous fumes present in the flue at any degree of heat obtainable by the combustion of the fuel used.

581. **Chimneys — Interior — Framing Around.)** In case of chimneys which are enclosed, or form part of the interior of any building, no joists or girders shall rest or be supported on the walls of such chimney, and the framing around chimneys of all kinds shall be so constructed that in no case will any joists or timbers be placed nearer than two inches from the outside face of walls of flues, and in no case shall the distance from the inside of any flue to any joists or timbers be less than seven inches.

582. **Chimneys—External Location of.)** (a) Chimneys built outside of the walls of buildings shall not encroach upon any street or alley, and shall be built as follows:

(b) If at least one side of such chimney abuts entirely upon the wall of an existing building and the chimney is throughout its entire length securely and firmly anchored to the walls of such existing building, the wall of such chimney may be built of hollow tiles, in which case, however, it shall have a cast iron base, lined with fire brick, extending to a height of at least ten feet above the street or alley grade.

583. **Chimneys—Isolated—Walls Surrounding Smoke Flues.)** Isolated chimneys shall be so designed and constructed that the stress in every part thereof, due to the weight of the stack itself and from wind pressure, shall not exceed the safe limits as provided in this Chapter for the material used.

*584. **Walls Forming Smoke Flues.)** The walls forming smoke flues of one hundred and forty-four square inches area or less shall be of brick, concrete, stone, or of any one of these and burnt fire-clay flue tile lining, *and such flue linings shall extend from the lowest opening to a distance of at least two feet above the roof joints.* If only one of the above materials is used it shall not be less than eight inches in thickness. Provided, however, that such flues having walls at least three inches in thickness of continuous concrete or interlocking or rabbited joint concrete sectional flues may be used without burnt fire-clay flue tile linings. If any one of the above materials is used in combination with burnt fire-clay tile flue lining it shall be not less than four inches in thickness, and the burnt fire-clay flue lining shall be not less than three-fourths inches in thickness, and built as herein described. The walls forming smoke flues of more than one hundred and forty-four square inches area and not more than three hundred square inches area shall be of brick, concrete, stone, or any one of these and burnt fire-clay flue tile lining. If any of the above materials is used alone, it shall be not less than thirteen inches in thickness. If any one is used in combination with burnt clay flue tile lining, it shall be not less than nine inches in thickness and the fire-clay flue tile lining shall be not less than three-fourths inch in thickness and built as herein required. The walls forming flues having an area greater than three hundred square inches and less than six hundred square inches shall be built of one of the materials described above not less than twelve inches in thickness, and flues having an area greater than six hundred square inches shall have walls of one of the materials described above not less than sixteen inches in thickness, and these walls may be reduced to twelve inches in thickness at a point not less than fifty feet above the top of the breeching; provided, however, that the material of which all chimneys are constructed shall be so proportioned that it will not be subjected to a greater stress than elsewhere herein fixed as the maximum safe stress for such material. *Amended February 20, 1911.

585. **Ventilating Ducts — Chutes — Walls Forming.)** Walls forming ventilating ducts and rubbish and ash chutes shall be constructed in accordance with the regulations governing the construction of smoke flues elsewhere herein contained. Walls forming ventilating ducts shall not be less than four inches thick, and when the ventilating duct is larger than two hundred and sixty square inches the walls shall be not less than eight inches thick.

586. **Smoke Pipes Passing Through Partitions—Woodwork Around.)** (a) Where smoke pipes of diameter of six inches or less pass horizontally through a wood or a plastered stud partition, they shall be surrounded by a ventilated thimble of incombustible material with a diameter at least twelve inches greater than the diameter of the pipe.

(b) Where a smoke pipe of a greater diameter than six inches passes through a wood or plastered stud partition, it shall be surrounded either by a body of brick, hollow tile, porous terra cotta or other incombustible substance, measuring at least eight inches all around such smoke pipe. Smoke pipes of less diameter than twelve inches shall be kept at least twelve inches distant from any combustible partition, ceiling or floor, and such woodwork immediately over and for a distance of two feet

on each side of such smoke pipe shall be covered with sheet metal or with porous terra cotta, hollow tile or plaster.

(c) Smoke pipes of greater diameter than twelve inches and less area than six square feet, shall be kept at least twenty inches away from any woodwork. Such woodwork shall be protected as above specified for smaller smoke pipes to a distance of four feet on each side of such smoke pipe; provided, that in case of low pressure boilers used for heating purposes only, the distance from a smoke pipe to any woodwork shall not be less than two feet.

(d) Whenever smoke pipes of larger area than six square feet are used, they shall be kept at least three feet distant from any woodwork, and such woodwork for a distance of at least six feet on either side of such smoke pipes shall be protected as before specified for smaller pipes.

587. **Floors—Protection of—Around Boilers, Furnaces, Etc.)** Wherever steam boilers, furnaces, ovens, coffee roasters, or other structures in which fires are maintained, except stoves for domestic purposes standing on legs and affording not less than four inches air space, are set inside of a building, the floors under the same if not already fireproof, shall be taken out and replaced by a floor of fireproof material extending not less than six feet in each direction from the boiler or such other appliances.

588. **Ceiling—Protection of—Around Boilers, Furnaces, Etc.)** The space between the tops of all steam boilers and furnaces and any wood ceiling construction shall in no case be less than three feet, unless such boiler carry not more than ten pounds pressure, in which case such space shall be not less than eighteen inches. All wood sheathing, wood laths or otner combustible ceiling finish, shall be removed from above and for a space of two feet on all sides of such boilers and smoke pipes and the ceiling given at least two coats of whitewash or fire-retarding paint, and the top of such boilers and the top and sides of such smoke pipes shall be covered with at least three inches of asbestos cement or two inches of eighty-five percent magnesia and an outer covering of one-half inch asbestos cement, or such equivalent protection as may be approved by the Commissioner of Buildings; or the under side of such wood ceiling construction over the boiler or furnace and also over the smoke pipe leading from same and extending at least two feet in each direction beyond the boiler or furnace and smoke pipe shall be protected either by three coats of plastering on metallic lath or wire netting, or at least two inches of porus terra cotta or hollow tile covered on the under side with a heavy coat of plaster. If metal is used in the construction of smoke-pipes, such metal shall be of thickness not less than No. 14 U. S. gauge.

589. **Boilers—Location of—Permit for.)** In all cases, boilers shall be so placed as to give ample room between any ceiling, wall or partition to connect or operate any valves or pipes or other connections used on such steam boilers. The size, number and location of boilers to be installed in any building shall be marked on the plans and, except in buildings of Class III, approved by the Department of Smoke Inspection of Steam Boilers and Steam Plants, and by the Department of Smoke Inspection, before a permit is issued by the Department of Buildings for the erection of such building.

590. **Cupolas of Foundries.)** Cupolas of foundries shall extend at least twenty-five feet above the highest point of any roof within a radius of forty feet of such cupola.

591. **Cornices — Eaves — Gutters — Pipes from Roof.)** (a) No wood shall be used for any purpose in connection with cornices, eaves and external gutters on any building more than fifty feet in height. The entire exterior covering of cornices and eaves of buildings hereafter to be erected within the fire limits shall be of incombustible material.

(b) Wherever sheet metal cornices or eaves or external gutters are used, their entire exterior covering shall be of metal or other incombustible material approved by the Commissioner of Buildings. Bracket supports for same shall be firmly secured to the wall at least every four feet, and the walls shall be carried full height under and behind same throughout their entire length.

(c) The water from all roofs shall be carried to the sewer in metal conductor pipes. Every such conductor shall be continually maintained in good condition, and if such conductors are within the exterior walls, they shall be of screwed-joint iron or steel pipe, or of cast iron pipe with calked joints.

592. **Towers, Domes and Spires—Construction of.)** Towers, domes and spires may be built on top of the roofs of buildings, but shall not occupy more than one-quarter of the street frontage of any building. Such towers, domes, or spires, if any part thereof is built to a height of more than fifty feet and less than ninety feet, shall be of slow-burning construction, and, if of a greater height then ninety feet above the sidewalk, shall be of fireproof construction; and, in all cases where the area of such tower, dome, or spire exceeds one hundred square feet, its supports shall be carried down to the ground, and shall be, if the structure supported is more than fifty feet and less than ninety feet high, of slow-burning construction, and, if more than ninety feet high, of fireproof construction. No tower, dome, or spire shall exceed thirty-six hundred (3,600) square feet in area, and in no case shall the area exceed fifteen per cent of the total area of the building on which it is erected, nor shall the height of any tower, dome or spire exceed four hundred feet measured from the established inside grade.

*592a. **Structures—Construction and Limitations of.)** All structures built within the City other than those otherwise specifically provided for herein shall be designed and constructed according to established engineering practice, and shall comply with the provisions of this section. No structure of frame or mill construction within the fire limits shall exceed 35 feet in height from the ground to the highest point thereof. No structure of mill or frame construction outside the fire limits shall exceed the height of 45 feet from the ground to the highest point thereof.

*All structures over thirty-five feet in height within the fire limits, and all structures over forty-five feet in height outside the fire limits shall be built of structural steel, concrete or masonry; *provided, however, that viaducts or runways to be used for the purpose of transferring livestock from one building or place to another may be built of wood not to exceed eighty feet in height either within or without the fire limits.*

*Amended July 22, 1912.

If it is desired to enclose any structure, such structure shall be enclosed with concrete or masonry walls, or incombustible material of such construction as shall be approved by the Commissioner of Buildings; provided that structures outside the fire limits not exceeding 2,800 square feet in area, or 45 feet in height, may be enclosed with combustible material.

In every structure contemplated by this section safe and adequate means of ingress and egress shall be provided for persons employed in and about the same.

All structures whose height exceeds twice their least dimensions at their base shall be so designed as to safely resist a wind pressure of 30 pounds per square foot of surface exposed to the action of the wind.

593. **Skylights—Construction of—Glass in.)** (a) Any skylight on the roof of any building less than ninety feet in height, other than a frame building, shall have the sides, sashes and frames constructed of metal, or of wood, metal clad on all exterior surfaces. Any skylight on a building more than ninety feet in height shall be entirely of incombustible material.

(b) Every skylight shall be provided with ventilation opening of an area of at least three per cent of the base area of the skylight.

(c) The glass in all such skylights, except in buildings in Classes III and VI, not exceeding three stories in height, shall have at least six inches over same a strong wire netting with wire not lighter than number twelve gauge, galvanized after weaving, and mesh not coarser than one by one inch, unless the glass contains a wire netting within itself. Supports for screen shall not be less in size than the bars supported and of the same material.

594. **Enclosures Upon Roofs.)** It shall be permitted to erect on the roofs of all buildings more than fifty feet and less than ninety feet high, skylights, inclosures for water tanks and inclosures for elevator machinery, the construction of all of which inclosures shall be entirely of incombustible material; provided, however, that the roofs of same may be built of mill or slow-burning construction.

595. **Roof—Construction of—Pitch of.)** Buildings, other than frame buildings when permitted by this Chapter, less than fifty feet in height with roofs which have a slope of more than three inches per horizontal foot, shall have the roofs covered with incombustible material. Buildings more than fifty feet and less than ninety feet in height with roofs which have a slope greater than three inches per horizontal foot and which are of timber construction, shall have such roofs covered with an incombustible covering upon the roof boards, which shall be made either of mortar or porus terra cotta or plaster boards or other incombustible material, which shall be at least two inches thick. Where this covering is placed upon the roof boards wooden strips shall be inserted, which shall be securely fastened to the wooden structure at regular intervals between the incombustible covering and a weatherproof covering of incombustible material.

596. **Roofs—Shingle or Gravel.)** (a) The use of shingles or other forms of combustible roof covering erected or altered, otherwise than provided in Section 657, within the fire limits, is prohibited, except as hereinafter provided. In existing frame buildings not more than three stories high, the shingle roofs may be repaired with shingles or other materials.

(b) Roofs, the slope of which is not more than three inches per foot horizontal, and the covering of which is made of a composition of felt and gravel, shall be considered incombustible under the provisions of this Chapter, and may be used upon buildings of all classes. Other forms of composition roof shall be permitted if expressly approved as an incombustible roof by the Commissioner of Buildings.

597. **Window and Door Sills—Columns and Lintels Supporting Store Fronts—Incombustible.)** (a) For buildings other than frame buildings window and door sills shall be made of incombustible material. Oak timber used for door sills and not less than eight inches thick by the full width of the wall in which such sills occur, shall, for the purpose of this Chapter, be counted incombustible.

(b) In buildings other than frame and excepting buildings of Classes III and VI, lintels shall be of incombustible material; provided that in one-story store front buildings columns and lintels may be of combustible material.

*598. **Buildings—Height of.)** *(a) The limits of heights of buildings heretofore given for non-fireproof buildings shall be from the average established sidewalk level to the highest point of the roof thereof.*

(b) The height of fireproof buildings shall be measured from the average grade of the street frontage of the building to the top of the highest point of the external bearing walls.

(c) No buildings shall be erected of greater height than two hundred feet from the sidewalk level to the highest point of external bearing walls; provided, however, that buildings may be erected of a height of two hundred sixty feet from the sidewalk level to the highest point of external bearing walls up to and until the first day of September, 1911, where a permit has been secured therefor and the work incident to the erection of said building has been begun before September first, 1911. The erection of parapet walls or of balustrades constructed entirely of incombustible material shall be permitted above the roof level of buildings of all classes, in addition to the height fixed herein for the same.

(d) Roof houses for elevators, tanks, skylights, stairs or scuttles may be built above the height of the main roof.

*Amended February 6, 1911.

599 **Basement and Cellar Defined.)** A basement shall be defined as a story the floor of which is more than two feet below the average finished street grade or whose ceiling is less than nine feet above said grade at the front of the building; but this definition of a basement shall not apply to buildings of Classes VI and VIII.

600. **Sub-basements and Cellars—Construction of.)** (a) No building shall have more than one basement or cellar of ordinary or slow-burning, or mill construction; all additional basements or cellars shall be of fireproof construction as described in this Chapter, the elevator enclosures shall be of brick from the lowest basement floor level to the first story floor, and the stairways shall be inclosed in fireproof partitions from the lowest basement floor level to the first story floor level with automatic closing standard iron doors, opening outwards.

(b) In cases where a pipe, conduit, dumb-waiter, cable, wire, conveyor or belt, or any combination thereof, passes through a floor from one basement to another, the opening in the floor shall be inclosed as specified in this Chapter.

(c) The number and width of stairs from the lowest basement floor to the first story shall be the same as required for the four highest stories of a building of the same area.

*601. **Canopy—Plans Must be Approved by Commissioner of Buildings Before Permit Issued by Department of Public Works—** *Fee for Permit—No Advertising Matter or Obstructions Permitted.)* It shall be unlawful for any person, firm or corporation to erect or construct any canopy *attached to a building or structure* under any general or special ordinance *now in force or* which shall or may hereafter be adopted by the City Council of the City of Chicago, without first submitting the plans of such canopy, *and also of the part of the building or other structure to which it is to be attached,* to the Commissioner of Buildings for his approval. No permit shall be issued by the Department of Public Works unless the plans of *such* canopy shall *be approved by the Department* of Buildings *and a permit to attach said canopy to the building for which it is intended shall be obtained from the*

Commissioner of Buildings. The owner or agent shall pay to the Department of Buildings a fee of $5.00 for said permit. No canopy that has been or may hereafter be authorized by any general or special ordinance, which projects over any street or other public place shall at any time be enclosed by canvas or other cloth or material in whole or in part so as to obstruct free passage underneath same, nor shall any such canopy be equipped with or have attached thereto any illuminated or other signs, transparencies, placards, streamers or other advertising devices of any kind; and in case any such canopy shall at any time contain such advertising matter or device it shall be the duty of the owner, lessee, or person in charge or control of such canopy, upon notice from the Mayor, to forthwith remove such advertising matter or device.

*Amended April 28, 1913.

602. **Courts and Light Shafts in Buildings.)** (a) Every court or light shaft of every building shall be open and unobstructed from the bottom of such court to the sky, with the exception that fire escapes may be built therein, and such courts shall have walls constructed in the same manner as is required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

(b) All windows, doors or other openings in court walls, except as otherwise provided in this Chapter, shall have metal frames, metal sashes and metal doors, with the glazed portions thereof of wired glass.

603. **Bay Windows—Light Courts—Shafts—Construction of.)** (a) The walls of every bay window and every court in every masonry constructed building, except buildings of Class III, shall be built of brick or other fireproof construction throughout as required for exterior walls.

(b) The walls of every vent shaft of every masonry constructed building, except buildings of Class III, shall be built of masonry or a fireproof material not less than four inches in thickness supported by steel or iron.

(c) Every court, light shaft, or vent shaft in every building shall be open and unobstructed from the bottom of such court to the sky with the exception that fire escapes may be built in courts or light shafts, subject to all the provisions of this Chapter.

(d) All windows, doors, or other openings in court walls, except as otherwise provided in this Chapter, shall have metal frames, metal sashes and metal doors with the glazed portion thereof of wired glass.

604. **Windows, Cleaning of—Safety Devices.)** The owner or agent of every building in the city shall equip each and every window in any such building above the first story thereof with a suitable device or devices which will permit the cleaning of the exterior of each and every window in such building above the first story without danger to the person cleaning such windows, and such devices shall be of such pattern and construction as will reasonably and safely answer the purposes for which they are intended; provided, however, that if windows are of such construction that they may be easily cleaned from the inside they need not be equipped with such devices.

*605. (a) **Wood Lathing and Plastering.)** *In all buildings of ordinary construction, where the use of wood lath and plaster is permitted under the provisions of this chapter, such wood lath and plaster shall be done in accordance with these specifications:*

Wood lath shall not be over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than one-fourth of an inch apart. All wood lath must be covered with at least two coats of plaster; such lath and plaster to finish to a total thickness of at least seven-eighths of an inch; no dirty or loamy sand to be used in the mortar or plaster.

(b) In every building of ordinary construction which contains one or more rooms used for habitation or living purposes, the walls and ceilings of all rooms, including stores (except basement and attic rooms not used for habitation or living purposes), throughout the building shall be covered with not less than two coats of plaster of the thickness and quality hereinbefore in this section prescribed.

Provided, however, that where such building does not exceed one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in the room used for the purpose of Class I; and provided further, that where such building of ordinary construction and containing one or more living rooms is more than one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in such room used for the purpose of Class I according to the following provisions:

The ceiling of the room or rooms used for the purpose of Class I shall first be plastered with at least one coat of plaster on wood lath; wood lath to be not over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than three-eighths of an inch apart. All wood lath to be covered with a heavy coat of mortar; such lath and plaster to finish to a total thickness of three-quarters of an inch in thickness. Before applying such metal ceilings, a wood strip not less than seven-eighths of an inch by one and one-quarter inch wide shall be used under every lap bead, or nailing flange at the intersection of all plates. Strips to be not more than two feet on centers in the direction of length of rooms with a cross strip every four feet on centers. A wire nail not less than three inches long shall be used in every strip at every joist in the surface to be covered. Metal plates to be not lighter than 29 gauge in thickness and nailed to every six inches on the lap.

(c) Where said metal-plates are applied on walls of buildings of ordinary construction containing one or more rooms used for habitation or living purposes, plastering upon walls must conform with the requirements of this ordinance for plastered walls. A strip three-eighths of an inch in thickness may be used upon which to apply the metal, same to be nailed to every studding with a nail not less than two and three-quarter inches long; steel plates used on walls to be not lighter than 29 gauge and applied same manner as herein provided for ceilings.

*Amended March 9, 1914.

606. **Scaffolds—Protection During Building Operations—Temporary Floors.)** (a) All scaffolds erected in this city for use in the erection, repair, alteration, or removal of buildings, shall be well and safely supported, and of sufficient width, and properly secured, so as to insure the safety of persons working thereon or passing under or by the same; and to prevent the falling thereof, or of any material that may be used, placed or deposited thereon.

(b) It shall be the duty of every owner, person or corporation who shall have the supervision or control of the construction of or remodeling of any building having more than three framed floors, whether some or all of such floors are above the established street grade, to provide and lay upon the upper side of the joists or girders, or both, of the first floor below the riveters and structural steel setters, a plank floor, which shall be laid to form a good and substantial temporary floor for the protection of the employes and all persons engaged above or below or on such temporary floor in such building.

(c) Provided, however, that where the permanent floor is in place on the floor herein required to be planked, a temporary protective floor shall not be required.

(d) A good and substantial temporary floor shall be laid on the joists or girders of the next lower floor where the temporary or permanent floor of the second story or the floor or floors above the second story or roof is being placed previous to the placing of the permanent floor or floors immediately below the floor which is being arched or planked. The lowest framed floor in a building shall be considered the first floor.

(e) In buildings more than three stories high where persons are working on a scaffold or scaffolds on the outside of such building such persons shall be protected by well secured planking, set over the heads of such persons for the full width of the scaffolding on which they are working if another story or other stories are being raised above such persons during the time they are working on such outside scaffold or scaffolding.

(f) It shall be the duty of all owners, contractors, builders or persons having the control or supervision of all buildings in course of erection which shall be more than thirty feet high, to see that all stairways, elevator openings, flues and all other openings in the floors shall be covered or properly protected, and it shall be their further duty to comply with an act of the State Legislature providing for the protection and safety of persons in or about the construction, repairing, alteration or removal of buildings, bridges, viaducts and other structures, approved June 3, 1907, and in force July 1, 1907.

(g) Any person, firm or corporation violating any of the provisions of this section shall be fined not less than one hundred dollars nor more than two hundred dollars for each offense, and any permit granted for the construction of such building may be revoked in the discretion of the Commissioner of Buildings where such violation occurs.

607. **Sidewalk and Street—Occupation of —Limitations.)** (a) The extent of occupation of sidewalk and street to be covered by the terms of a permit for street obstruction or building, shall be as follows:

(b) Such permit shall not authorize the occupation of any sidewalk or street or part thereof other than that immediately in front of the lot or lots upon which any building is in process of erection and in relation to which such permit is issued.

(c) During the progress of building operations, a sidewalk not less than six feet in width shall be at all times kept open and unobstructed for the purpose of passage in front of such lot or lots. Such sidewalk shall, if there are excavations on either side of the same, be protected by substantial railings which shall be built and maintained thereon so long as excavations continue to exist. It is not intended hereby to prohibit the maintenance of a driveway for the delivery of material across such sidewalk from the curb line to the building site.

608. **Sidewalks—Delivery of Material—Elevated Sidewalks.)** It shall be permitted for the purposes of delivering material to the basements of buildings in process of erection to erect elevated temporary sidewalks to a height of not exceeding four feet above the curb level of the street, and in case a sidewalk is so elevated it shall be provided with good, substantial steps or easy inclines on both ends of the same and shall have railings on both sides thereof.

609. **Temporary Roof Over Sidewalk—Time Maintained.)** When buildings are erected of a height greater than four stories and such buildings are near the street line, there shall be built over the adjoining sidewalk a roof having a framework composed of supports and stringers of three by twelve timbers not more than four feet from center to center, covered by two layers of two-inch plank. When additonal stories are added to an existing building and such building is located near the street line, there shall be built over the sidewalk, at the point where the new stories commence, a scaffold not less than six feet wide, which shall form a covering over the sidewalk composed of a framework of stringers and supports, covered by two layers of two-inch planks. Such framework and covering shall be of such construction and design as shall be satisfactory to the Commissioner of Buildings. Such roof shall be maintained as long as material is being used or handled on such street front above the level of the sidewalk. Temporary sidewalks, their railings, approaches and roofs over same, shall be made with regard to ease of approach, strength, and safety, to the satisfaction of the Commissioner of Buildings.

610. **Storage of Building Materials—Limitations.)** The occupation of the street for the storage of building material for any one building or for temporary sidewalks, shall never exceed one-third of the width of the roadway of the same, and in no event shall any material be stored or placed within four feet of any steam or street railway track, and in all cases where such obstruction of the street is made there shall be a clear space of not less than one foot between such obstruction and the curb line. Provided, that the Commissioner of Buildings and the Commissioner of Public Works, or either of them, may limit, or entirely restrict, the storage of material on any street or alley where a tunnel, conduit, or any underground passageway or subway is located.

611. **Sidewalks and Street — Excavated Material and Rubbish On—How Cared for.)** Earth, other than sand to be used in the construction of the building, taken from excavations, and rubbish taken from buildings shall not be stored either upon the sidewalks or roadways of streets, and shall be removed therefrom from day to day as rapidly as produced. When dry rubbish is being handled, it shall be kept wetted down so as to prevent its being blown about by the wind.

612. **Use of Derricks.)** For all buildings more than four stories in height the use of derricks set upon the sidewalk or street is prohibited. In no case shall the guy lines be less than fifteen feet above the roadbed.

613. **Frontage Adjacent—How Occupied for Building Purposes.)** If the written consent of and a waiver of claims for damages against the city by the owners of properties adjoining the site of any proposed building is first obtained and filed with the Commissioner of Public Works, the permission to occupy the roadway and the sidewalk may be extended beyond the limits of such building in front of the property for which the consent of the owner or lessee thereof has been secured upon the same terms and conditions as those herein fixed for the occupation of sidewalk and street in front of the building site.

614. **Street—Use of for Building Purposes—When Terminated—Red Lights.)** (a) The permission to occupy streets and sidewalks for the purposes of building is intended only for use in connection with the actual erection, repair, alteration or removal of buildings, and shall terminate with the completion of such operation. It shall be unlawful to occupy any sidewalk or street after the completion of the operation for which a permit has been issued by the Department of Buildings. It shall also be unlawful to occupy a sidewalk or street, under authority of such permit, for the storage of articles not intended for imme-

diate use in connection with the operations for which such permit has been issued.

(b) Red lanterns shall be displayed and maintained during the whole of every night at each end of every pile of material in any street or alley and at each end of every excavation.

615. **Street Obstructions—Permits—Bonds—Fees.)** (a) Permits for the obstruction of streets shall be issued by the Commissioner of Public Works and shall be paid in proportion to the street frontage occupied at the rate of two dollars per month for every twenty-five (25) feet, or fractional part thereof, of frontage so occupied, and before any permit shall be granted to any person, firm or corporation for the obstruction of any street or streets or sidewalk, an estimate of the cost of restoring said street and sidewalk to a condition equally as good as before it shall have been obstructed, with a fair additional margin for contingent damages, shall be made by the Commissioner of Public Works, which in no case shall be less than one dollar per foot, or fractional part thereof, frontage of the portion of the street to be obstructed, and a deposit shall be required of the person, firm or corporation desiring to obstruct said street or sidewalk. Such deposit, less the charge of two dollars per month for each twenty-five feet of frontage used, shall be returned upon the restoration of the said street and sidewalk to a condition equally as good as before it was obstructed. When the Commissioner of Public Works shall receive satisfactory proof that said street and sidewalk have been restored to a condition equally as good as before it was obstructed, he shall issue a certificate to the Comptroller, certifying to said fact, and the comptroller shall thereupon forthwith issue a warrant on the City Treasurer for the amount of money thus deposited less the deduction herein provided for. But if the person, firm or corporation thus obstructing said street or sidewalk shall fail to restore the same to a condition equally as good as before it was obstructed within three (3) days from and after the completion of the building or structure for which said deposit was required, then the city shall have the right to use such portion of said deposit as may be necessary to remove the obstructions and to restore the said street and sidewalk to a condition equally as good as it was before it was obstructed, and the amount thus expended shall be deducted from the amount of said deposit; provided, however, that nothing herein contained shall preclude the city from maintaining an action against the person, firm or corporation to recover for damage done to any street or sidewalk. No permit shall be issued until the applicant therefor shall have executed and filed with the Commissioner of Public Works a bond, with sureties to be approved by said Commissioner, and in an amount to be designated by him, in no case to be less than ten thousand dollars, conditioned to indemnify, save and keep harmless the city from any and all loss, cost, expense or liability of any kind whatsoever which it, the city, may suffer or be put to, or which may be recovered from it from or by reason of the issuance of such permit, or by reason of any act or thing done or neglected to be done under or by virtue of the authority given in such permit and the requirements of the city ordinances.

(b) Any permit issued pursuant to the terms of this ordinance may be revoked by the Commissioner of Public Works at any time.

616. **Stables and Barns—Regulations.)** (a) It shall be unlawful for any person, firm or corporation to convert any building for the use of or to construct or maintain any stable or barn for the housing or keeping of horses or other animals on any lot abutting on a street or alley in which a public sewer is constructed without providing such stable or barn with an impervious floor properly drained to such sewer.

(b) It shall be unlawful for any person, firm or corporation to construct, locate, conduct or maintain any boarding, sales or private stable or barn for stabling or keeping of horses on the front two-thirds of any lot on any street where one-half of the buildings on both sides of the street between the next nearest intersecting streets are used exclusively for residence purposes without the written consent of a majority of the property owners according to frontage on both sides of the streets. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or alteration of any building or place for such purpose. Provided that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street and located upon a corner lot shall not be considered.

*(c) *It shall hereafter be unlawful for any person, firm or corporation to locate, build, construct or maintain any building or structure for stabling or keeping of ten or more horses within a distance of two hundred feet from any school, church, hospital, public park or public playground.*

*Amended June 22, 1914.

(d) Any person, firm or corporation violating any of the provisions of this section shall be fined not less than twenty-five dollars ($25.00) nor more than two hundred dollars ($200.00) for each offense and each and every day on which such person shall conduct or maintain a stable or barn in violation of the provisions of this section, shall constitute a separate and distinct offense.

*Amended November 18, 1912.

617. **Tannery Not to Be Placed Within 600 Feet of Any Church, Public or Private School.)** It shall be unlawful for any person, firm or corporation to build, construct, locate or maintain any building used, or to be used, for a tannery within six hundred feet measured from the nearest point of the tannery to the nearest point of any building used for a church or for a public or private school.

617½. **Gas Reservoir Not to Be Placed Within 500 Feet of any Public School.)** It shall be unlawful for any person, firm or corporation to build, construct, locate or maintain any tank used or to be used for a gas reservoir within 500 feet of any public school. Said distance to be measured from the nearest point of the building or structure used for a gas reservoir to the nearest point of any building used for a public school.

618. **Architect—Must Certify That Plans Comply With Building Ordinances.)** It shall be unlawful for any architect or other person permitted under the state law to prepare plans to prepare and submit to the Commissioner of Buildings for his approval any final plans for any building or structure which do not comply with structural requirements of this Chapter. It shall be the duty of the Commissioner of Buildings to require that all final plans submitted to him for approval of any building or structure shall be accompanied by a certificate of such architect or such other person preparing plans that the plans and specifications submitted comply with the structural requirements of this Chapter.

ARTICLE XIII.

Fireproof Construction.

*619. **Fireproof Construction—Definition of.)** *The term "fireproof construction" shall apply to*

all buildings in which all parts that carry weights or resist strains and also all exterior walls and all interior walls and all interior partitions and all stairways and all elevator inclosures are made entirely of incombustible material, and in which all metallic structural members are protected against the effects of fire by coverings of a material which shall be entirely incombustible, and a slow heat conductor, and hereinafter termed "fireproof material." Reinforced concrete as defined in this ordinance shall be considered fireproof construction, when built as required by Section 564.

*Amended February 20, 1911.

620. **Fireproof Material—Definition of.)** The materials which shall be considered as filling the conditions of fireproof covering are: First, burnt brick; second, tiles of burnt clay; third, approved cement concrete; fourth, terra cotta.

621. **Fireproof Construction—Tests For.)** (a) In cases in which it is claimed that any equally good or more desirable mode or manner of construction, or material, or device for fireproofing, other than specified in this Chapter, can be used in the erection or alteration of buildings, the Commissioner of Buildings, upon written application to him for a permit to use the same, shall have power to appoint a Board of Examiners, consisting of not less than three nor more than five members, each of whom shall have at least ten years' experience as an architect, engineer or builder, who shall take the usual oath of office. Said oath of office shall be administered by the Commissioner of Buildings. The said examiners shall adopt rules and specifications for examining and testing such mode or manner of construction or material, or device for fireproofing, and furnish a copy of the same to the applicant. And such specifications shall provide that the material to be tested shall withstand successfully a fire of two hours' duration, rising to 1,700 degrees temperature, Fahrenheit, in the first thirty minutes and remaining at that temperature for the following ninety minutes. At the end of the two hours the material shall be quenched with at least a 1¼-inch stream of water for five minutes, at a nozzle pressure of fifty pounds per square inch. The said examiners shall notify such applicant to submit the proposed material for such examination and test; and such tests shall be made in the presence of the said examiners, or a majority thereof, according to such rules and specifications. All expenses of such examiners and such examinations and tests, shall be paid by the applicant, and said examiners may require security therefor.

(b) The said examiners shall within 30 days after such examination and tests, certify the results of such test, and their decision on the said application to the Commissioner of Buildings, who shall in the event of the examination and tests being satisfactory, authorize the use of such material or construction as fireproof material.

(c) A complete record of the proceedings and all acts and decisions of the said Board of Examiners shall be kept by the Commissioner of Buildings in his office.

(d) The Commissioner of Buildings shall have the power to pass upon any question relative to the mode or manner of construction or materials to be used for fireproofing in the erection or alteration of any building or structure to make the same conform to the true intent and meaning of the several provisions of this Chapter.

*622. **Incombustible Material.)** *The following materials shall be considered as incombustible material: A metal or fire-resisting glass not less than one-quarter of an inch in thickness, metal, plastering on metal lath and metal-studding, plaster blocks, stone, granite, marble, approved cinder concrete, or one of the fireproof materials described in this chapter.*

*Amended February 20, 1911.

623. **Walls—Enclosing in Buildings of Steel Skeleton Construction.)** If buildings are made of fireproof construction, and have skeleton construction so designed that their enclosing walls do not carry the weight of floors or roof, then their walls shall not be less than twelve inches in thickness; provided, such walls shall be thoroughly anchored to the iron skeleton, and whenever the weight of such walls rests upon beams or columns, such beams or columns shall be made strong enough in each story to carry the weight of wall resting upon them without reliance upon the walls below them. All walls shall be of fireproof or incombustible material.

624. **Columns—Exterior.)** (a) All iron or steel used as vertical supporting member of the external construction of any building exceeding fifty feet in height shall be protected against the effects of external change of temperature, and of fire by a covering of fireproof material consisting of at least four inches of brick, hollow terra cotta concrete, burnt clay tiles, or of a combination of any two of these materials, provided that their combined thickness is not less than four inches. The distance of the extreme projection of the metal, where such metal projects beyond the face of the column, shall be not less than two inches from the face of the fireproofing; provided, that the inner side of exterior columns shall be fireproofed as hereafter required for interior columns.

(b) Where stone or other incombustible material not of the type defined in this ordinance as fireproof material is used for the exterior facing of a building, the distance between the back of the facing and extreme projection of the metal of the column proper shall be at least two inches, and the intervening space shall be filled with one of the fireproof materials.

(c) In all cases, the brick, burnt clay, tile or terra cotta, if used as a fireproof covering, shall be bedded in cement mortar close up to the iron or steel members, and all joints shall be made full and solid.

625. **Columns—Interior.)** (a) Covering of interior columns shall consist of one or more of the fireproof materials herein described.

(b) If such covering is of brick it shall be not less than four inches thick; if of concrete, not less than three inches thick; if of burnt clay tile, such covering shall be in two consecutive layers, each not less than two inches thick, each having one air space of not less than one-half inch, and in no such burnt clay tile shall the burnt clay be less than five-eighths of an inch thick; or if of porous clay solid tiles, it shall consist of at least two consecutive layers, each not less than two inches thick; or if constituted of a combination of any two of these materials, one-half of the total thickness required for each of the materials shall be applied, provided that if concrete is used for such layer it shall not be less than two inches thick.

(c) In the case of columns having an "H" shaped cross section or of columns having any other cross section with channels or chases open from base plates to cap plates on one or more sides of the columns, then the thickness of the fireproof covering may be reduced to two and one-half inches, measuring in the direction in which the flange or flanges project, and provided that the thin edge in the projecting flange or arms of the cross sections does not exceed three-quarters of an inch in thickness. The thickness of the fireproof covering on all surfaces measuring more than three-quarters of an inch wide and measuring in a direc-

tion perpendicular to such surfaces shall be not less than that specified for interior columns in the beginning of this section, and all spaces, including channels or chases between the fireproof covering and the metal of the columns, shall be filled solid with fireproof material. Lattice or other open columns shall be completely filled with approved cement concrete.

626. **Columns—Wiring Clay Tile On.)** (a) Burnt clay tile column covering shall be secured by winding wire around the columns after the tile has all been set around such columns. The wire shall be securely wound around tile in such manner that every tile is crossed at least once by a wire. If iron or steel wire is used it shall be galvanized and no wire used shall be less than number twelve gauge.

(b) In places where there is trucking or wheeling, or handling of packages of any kind, the lower five feet of every column with hollow tile shall be incased in a protective covering of No. 16 U. S. gauge steel embedded in concrete.

*627. **Concrete—Approved Cement—When Fireproof.)** (a) All approved cement concrete shall consist of a standard Portland cement, torpedo sand, and crushed stone or gravel, or crushed blast furnace slag, or crushed burnt clay, the volumetric quantity of any one of these materials in addition to the torpedo sand shall not exceed eight times the volume of the Portland cement. All of the ingredients of cement concrete shall be thoroughly worked and wet so as to cover each piece of stone or gravel or slag or burnt clay with moistened cement; and the cement and sand shall fill the voids between the coarse material of the cement concrete.

(b) Cement concrete to be considered a fireproof material shall comply with the provisions of Section 564 and shall be cast and worked in an unset condition against the metal. In all cases where cinder concrete is used, the metal shall be protected as required by Section 568 of this Chapter.

*Amended February 20, 1911.

628. **Concrete Ingredients.)** (a) The separate ingredients of concrete shall be measured for each batch, and shall be thoroughly mixed and must be uniform in color, appearance and consistency before placing. The concrete shall be worked continuously with suitable tools, as it is put in place, filling the forms completely.

(b) The sand to be used for concrete shall be clean coarse sand, free from loam or dirt. If crushed stone grit is used it shall be clean, gritty, and free from dust.

(c) The stone to be used in concrete shall be clean crushed hard stone, or clean crushed blast furnace slag, or gravel, and of a size to pass through a 1½-inch square mesh. If limestone or slag is used, it shall be screened to remove all dust; if gravel is used, it shall be thoroughly washed. Stone shall be drenched immediately before using.

(d) In all cases, the brick or hollow tile, solid or terra cotta shall be bedded in cement mortar close up to the iron or steel member and all joints shall be made full and solid.

629. **Pipes Enclosed by Covering.)** (a) Pipes shall not be enclosed in the fireproofing of columns or in the fireproofing of other structural members of any fireproof building; provided, however, gas or electric light conduits not exceeding one inch diameter may be inserted in the outer three-fourths inch of the fireproofing of such structural member, where such fireproofing is entirely composed of concrete.

(b) Pipes or conduits may rest upon the tops of the steel floor beams or girders, provided they are imbedded in cinder concrete to which slaked lime equal to five per cent of the volume of concrete has been added before mixing or their being imbedded in stone concrete.

630. **Shafts—Doors—Frames—Enclosure.)** (a) In cases where a pipe, conduit, dumb waiter, cable wire, conveyor, belt, or any combination thereof, passes from one story to another story through an open hatch or floor opening, a shaft or enclosure of fireproof material shall be built from floor to floor around such hatch or floor opening in each story above and below such hatch or floor opening in the same manner as described for fireproof partitions in this chapter, and no wood shall be used in the construction, support or fittings of such shaft. The area of space thus enclosed shall not exceed the area of the floor opening by more than one hundred per centum.

(b) All burnt clay or terra cotta partitions or walls around such shafts shall be plastered on the outside and plastered or pointed on the inside.

(c) All doors, frames, sashes, casings and windows in partitions or walls around such floor openings, shall be built of incombustible material. The supports of such doors, frames, sashes, casings and windows shall also be of incombustible material. In the case of doors, such supports shall be of rolled structural metal extending from floor to ceiling and secured to both. Where there are brick walls of twelve inches or more in thickness, the supports need not extend to ceiling as above specified. All glass used in connection with such partitions or walls shall be wired glass.

(d) Such fireproof enclosures may be omitted if all of the space in each floor opening not occupied by pipes, conduits, cables, wires, or any combination thereof, are filled in solid fireproof material not less than eight inches thick.

631. **Spandrel Beams, Girders, Lintel.)** The metal of the exterior side of the spandrel beams or spandrel girders of exterior walls, or lintels of exterior walls, which support a part of exterior walls, shall be covered in the same manner, and with the same material as specified for the exterior columns in this chapter; provided, however, that shelf angles connected to girders by brackets or projections of girder flanges not figured as part of the flange section, may come within two inches of the face of the brick or other covering of such spandrel beams, girders or lintels. The covering thickness shall be measured from the extreme projection of the metal in every case.

632. **Beams, Girders and Trusses—Coverings of.)** (a) The metal beams, girders and trusses of the interior structural parts of a building shall be covered by one of the fireproof materials hereinbefore specified so applied as to be supported entirely by the beam or girder protected, and shall be held in place by the support of the flanges of such beams or girders and by the cement mortar used in setting.

(b) If the covering is of brick, it shall be not less than four inches thick; if of hollow tiles or if of solid porous tiles, or if of terra cotta, such tiles shall be not less than two inches thick, applied to the metal in a bed of cement mortar; hollow tiles shall be constructed in such a manner that there shall be one air space of at least three-fourths of an inch by the width of the metal surface to be covered within such clay coverings; the minimum thickness of concrete on the bottom and sides of metal shall be two inches.

(c) The top of all beams, girders, and trusses, shall be protected with not less than two inches of concrete or one inch of burnt clay bedded solid on the metal in cement mortar.

(d) In all cases of beams, girders or trusses, in roofs or floors, the protection of

the bottom flanges of the beams and girders and so much of the web of the same as is not covered by the arches shall be made as hereinbefore specified for the covering of beams and girders. In every case the thickness of the covering shall be measured from the extreme projection of the metal, and the entire space or spaces between the covering and the metal shall be filled solid with one of the fireproof materials, excepting the air spaces in hollow tile.

(e) Provided, however, that all girders or trusses when supporting loads from more than one story shall be fireproofed with two thicknesses of fireproof material or a combination of two fireproof materials as required for exterior columns in Section 625 of this chapter, and each covering of fireproof material shall be bedded solid in cement mortar.

633. **Fireproofing of Exterior Sides of Mullions.)** In buildings required by this chapter to be of fireproof construction on exposures where metal frames, doors, sash and wired glass are not required, all vertical door or window mullions over eight inches wide shall be faced with incombustible material, and horizontal transom bars over six inches wide shall be faced with a fireproof or with an incombustible material.

634. **Fireproof Covering, Independent.)** The fireproof covering of brick, concrete, burnt clay tiles, hollow terra cotta or of a combination of any two of these materials shall be applied to all of the structural members of the exterior of a fireproof building previous to and independent of the application of the architectural facing of such fireproof building with an incombustible or fireproof material.

635. **Walls, Support and Fireproofing of.)** Where skeleton construction is used for the whole or part of a building the enveloping material and the walls shall be independently supported on the skeleton frame for each individual story.

636. **Iron or Steel Plates for Support of Wall.)** Where iron or steel plates or angles are used in each story for the support of the facings of the walls of such story, such plates or angles shall be of sufficient strength to carry the weight within the limits of fibre stress for iron and steel elsewhere specified in this chapter of the enveloping material for such story, and such plates or angles may extend to within two inches of the exterior of such covering.

637. **Cut-out Boxes, Chases, Etc.—Fireproof Covering.)** No electric service cut-out box, switch box, cabinet, chase or any other recess, shall encroach on the minimum thickness required for any fireproof covering on structural metal, except as provided in this chapter. If the depth of any cut-out box, switch box, cabinet, or chase, or if any other recess is to be concealed, or partially concealed, then the thickness of the fireproof covering shall be increased correspondingly.

638. **Segmental and Flat Arches.)** (a) Segmental arches shall have a rise of at least one inch for each foot of span of arch.

(b) The least thickness of a hollow tile or porous terra cotta segmental arch shall be one-half of an inch per foot of span, but no such hollow tile or terra cotta arch shall be of a thickness less than five inches.

(c) Both flat and segmental arches shall be so constructed that the joints of the same radiate from a common center and there shall be a cross rib for every four inches, or fractional part thereof, in height in each tile block. The skewback of the arches, shall be carefully fitted to the beams supporting them, and, in addition to the cross ribs, there shall be additonal diagonal re-enforcing ribs in the skewback. Such arches, whether flat or curved, shall have their beds well filled with cement mortar, and the centers shall not be struck until the mortar has set.

(d) Burnt clay skewbacks shall be molded in such a manner as to support the burnt clay covering on the under sides of beams or girders.

639. **Fireproof Floor and Roof Construction.)** Brick, hollow tile, porous terra cotta, or approved cement concrete, or approved cinder concrete, shall be used for the construction of floor and roofs of fireproof buildings. Flat arch hollow tile, or flat arch porous clay tile floor arches shall have a height of at least one and one-half inches for each foot of span.

640. **Wood Flooring and Nailing Strips.)** (a) Wood flooring and wooden nailing strips for such flooring may be used in fireproof buildings.

(b) Where such flooring is used in a fireproof building, the space immediately under the flooring, and between the nailing strips and under such nailing strips, shall be filled with a cement or a cinder concrete tamped into place in an unset state, or with such other incombustible material as shall be approved by the Commissioner of Buildings.

641. **Partitions in Fireproof Buildings.)** (a) Where stairs, shafts and elevators are enclosed they shall be enclosed in fireproof partitions, as described in Section 642 of this chapter; all other partitions, shall be incombustible partitions. Where blocks are used for building partitions or as enclosing walls, the joints shall be well filled with mortar.

(b) The partitions shall be wedged tight between floor and ceilings with incombustible wedges.

642. **Partitions — Fireproof — Incombustible.)** (a) Only fireproof material shall be used for fire proof partitions; if of brick, they shall be not less than four inches thick, and if of partition blocks, not less than three inches thick. If fireproof partitions are of reinforced concrete they shall be not less than three inches thick.

(b) All fireproof partitions required by this ordinance shall be supported directly on the steel construction, or on the fireproof floor arches, or on concrete, or on brick.

(c) Only fireproof or incombustible material shall be used in the construction of partitions not required to be fireproof, excepting that frames, casings, doors, sash and the rough carpenter work required for the proper fastenings of such frames, casings, doors or sash, may be of wood, and that ordinary glass may be used in doors and partition windows.

(d) All corridor partitions of incombustible or fireproof material in fireproof buildings, shall be supported directly on the steel construction, on the fireproof floor arches, on concrete or on brick.

643. **Stairs—Landings.)** (a) Stairs in fireproof buildings shall be built of approved cement concrete, reinforced concrete, stone or metal, or a combination of one or more of such materials.

(b) The handrails of such stairways may be of wood.

(c) If stairs are constructed of solid stone or plain concrete, having the tread and riser in one piece, then there shall be not less than sixty square inches of stone or concrete in the cross section of such combined tread and riser.

(d) If stone treads have less than sixty inches of cross section and platforms less than seven inches in thickness are used, they shall have a metal sub-tread and sub-platform three thirty-seconds of an inch thick.

(e) If platforms have a floor arch subconstruction as described in Sections 638 and 639 of this chapter, then the metal subplatform may be omitted.

644. **Roofs—Rise of Roof Above Limit of Height.)** In the case of buildings which are fireproof in their construction, the roof may rise above the limit of height of wall fixed by this chapter for such buildings at a slope not to exceed thirty degrees with the horizon, and to a height not exceeding twenty feet above such limitation of the height of the wall. The space enclosed by such roof above the limitation of the height of such wall may be used as an inclosure for pipes, ventilating or elevator machinery or for ventilating ducts, but it shall not be lawful to use such space for purposes of storage, business or residence.

645. **Sheet Metal Work—Support Of.)** Wood shall not be used as the support of any sheet metal work or of any gutter or cornice of a building more than ninety feet in height.

ARTICLE XIV.

Slow Burning Construction.

646. **Slow-Burning Construction Defined.)** The term "Slow-Burning Construction" shall apply to all buildings in which the structural members, other than walls elsewhere required to be of masonry, which carry the loads and strains which come upon the floor and roofs thereof are made wholly or in part of combustible material, but throughout which the structural metallic members, if used, shall be protected against injury from fire by coverings of fireproof material. The lower five feet of metal columns shall be protected as required in Section 634 of this chapter. Underside of joists shall be protected by a covering of three coats of plaster laid on metal lath; and a layer of mortar or other incombustible material at least one and one-half inches thick shall be applied on all floors and roof surfaces above the joists of the same.

*647. **Posts, Girders and Partitions.)** *Wood posts, if used, shall be of not less than one hundred square inches sectional area. Wood girders, if used, shall be of not less than seventy-two square inches sectional area. All partitions in buildings of this type shall be made entirely of incombustible material. Wood furring, wood studs and wood lath shall not be permitted in buildings of this type.*

*Amended February 20, 1911.

648. **Stairs, Construction of.)** Where buildings are required to be of "slow burning" construction, all stairs in such building shall be of incombustible material, except as hereinafter provided. Said stairs may be of ordinary construction, if said building is equipped with an automatic sprinkler system, and stairs are enclosed in a fireproof wall.

ARTICLE XV.

Mill Construction.

649. **Definition—Mill Construction Requirements.)** The term "Mill Construction" shall apply to all buildings in which wooden posts, if used, have a sectional area of not less than one hundred square inches, and wooden girders and joists a sectional area of not less than seventy-two square inches, and roofs, if of wood, a thickness of not less than two and five-eighths inches in a single layer, and floors, if of wood, a thickness of not less than three and one-half inches in not more than two layers, the lower one of which shall be not less than two and five-eights inches in thickness, and in which all structural metallic members, if used, are fireproofed as required for fireproof construction, and in which all floors and roofs not constructed as above are of fireproof construction as elsewhere required for fireproof construction in this ordinance.

*650. **Fireproofing.)** *(a) Partitions in buildings of mill construction shall be made entirely of incombustible material. If iron columns, girders, or beams are used in buildings of this type they shall be protected as specified in this Chapter; but the wooden posts, girders and joists need not be protected by fireproof covering. Wood furring, wood studs and wood lath shall not be permitted in buildings of this type.*

*Amended February 20, 1911.

(b) If reinforced cinder concrete construction is used in the structural parts of a building which is required to be of slow-burning or mill construction by this chapter, then all partitions shall be of incombustible material and all parts other than structural parts and partitions of the building shall be as required for slow-burning or mill construction buildings by this chapter.

651. **Stair Construction Where Automatic Sprinkler System is Installed.)** In buildings required to be of "mill construction," all stairs in such buildings shall be of "incombustible" material, except as hereinafter provided. Said stairs may be of wood construction if said building is equipped with an automatic sprinkler system and stairs are enclosed in a fireproof wall.

ARTICLE XVI.

Ordinary Construction.

652. **Ordinary Construction Defined.)** The term "ordinary construction" as used in this chapter, means the ordinary system of construction in which timber and iron structural parts are not protected with fire-resisting coverings and in which the walls are of masonry built as required by this chapter.

ARTICLE XVII.

Frame Buildings.

653. **Repairing of Frame Buildings Within Fire Limits.)** Frame buildings within the fire limits which have been damaged by fire, decay or otherwise, to an extent not greater than fifty per cent of their value may be repaired, provided there is no increase in size of such buildings over their original dimensions, and, provided that incombustible roof covering required by Section 596 is used. And, provided, further, that where any frame building is raised for the purpose of erecting a basement story under the same, the walls enclosing such basement shall be of masonry.

*654. **Frame Buildings Prohibited—Exceptions.)** (a) Hereafter no frame building shall be erected, nor any frame addition made to any existing frame building, within the fire limits of the city, except where express provision is made in this chapter therefor.

(b) Outside the fire limits it shall be lawful to erect frame buildings not exceeding forty feet in height from the sidewalk to the highest point of roof. If such frame buildings have a basement story of masonry, their height above the sidewalk may be made not to exceed forty-five feet. Provided, however, that in no case shall any portion of any frame building above the second floor be used as a separate living apartment.

(c) *It shall be lawful to surround frame buildings with a veneer of brick not less than four inches in thickness, provided the said brick is not carried higher than the second story, or twenty-two feet above the basement ceiling; and provided further that the said veneer is anchored to the studding or other frame construction in a manner satisfactory to the Commissioner of Buildings. Such brick veneer is not to be placed on gables or any other parts of frame buildings above the height*

herein specified. All frame buildings which it is desired to surround with brick veneer must have their basement walls and foundations of solid masonry, as provided in Section 658 of The Chicago Code of 1911.

*Amended March 19, 1912, by adding ¶(c).

655. **Frame Buildings Within the Fire Limits Changed Into Flat Buildings—Fire Walls.)** Whenever any frame building within the fire limits shall be remodeled, altered or changed for the purpose of using the same for flats or apartments, or whenever such frame building shall be occupied for flat or apartment purposes, each suite of apartments in such building shall be separated from every other suite of apartments in such building by a wall of incombustible material, of such dimensions and thickness as required by this chapter.

656. **Frame Buildings—Raising—Requirements—Changing Gable or Hip Roofs to Flat Roofs.)** Permission may be granted by the Commissioner of Buildings for the raising of existing frame buildings, whether within or without the fire limits, to the limits of height hereinbefore fixed for new frame buildings, and no more, and inside the fire limits for the purpose of putting a masonry basement thereunder. The Commissioner of Buildings is also authorized to issue permits for changing gable or hip roofs of existing frame buildings to flat roofs, and for the raising of walls incident to such change. But if such hip or gable roof is changed to a flat roof and the walls raised in connection with such change, the total cubic contents included by the walls so raised and the roofs so altered shall not exceed the cubic contents originally included in such gable or hip roof, and in no case shall a two-story and attic building be converted into a three-story building thereby.

657. **Frame Buildings Carried to a Uniform Height.)** Where the different parts of a frame building inside the fire limits are of different heights a one-story portion may be raised to the height of two stories, provided the greatest height thereof does not exceed the limits of height prescribed in this chapter for frame buildings, and provided, that no room in the existing building or in the addition thereto shall violate the requirements of this chapter for habitable rooms.

*658. **Basement or Story Placed Beneath Frame Buildings.)** A frame building may be raised for the purpose of erecting a basement or story, or both, thereunder, but the principal floor of such frame building shall not be raised to a higher level than 16 feet above the grade of the sidewalk upon which such premises abut. *Where a building so raised one story in height only and the same is raised so as to permit a basement under the same not to exceed six feet six inches in height from the basement floor to the ceiling of said basement, the said house may be placed upon cedar posts. In all other cases* the walls enclosing such basement or story shall be of masonry and not less than 12 inches thick except where a one-story frame building is raised and has a basement only built thereunder, the masonry walls of such basement may be eight inches thick above grade and 12 inches thick below. The foundation of such wall shall be constructed as provided in this chapter; provided, however, that no frame building shall be raised for the purpose of constructing a basement or story, or both, under the same to a greater height to the top of its roof than that elsewhere herein given as the maximum height above grade for frame buildings. The thickness of walls hereinbefore required shall also apply to brick walls in new frame buildings.

*Amended July 8, 1912.

*659. **Chimneys in Frame Buildings—Chimney Flues Through Partitions.)** *(a) Chimneys in frame buildings shall be built as required by Section 584 of this chapter. The wood framing of frame buildings shall be trimmed around chimneys in such a manner as not to come within two inches of the same.*

(b) Metal smoke pipes or tile flues shall not extend through the floors or through the ceiling or roof of any building; and where such smoke pipes or tile flues pass through partitions the woodwork of such partitions shall be protected by a sheet metal ventilated tin thimble at least twelve inches greater in diameter than the diameter of the flue.

*Amended February 20, 1911.

660. **Lot Lines—Requirements as to—Number—Dimensions.)** Frame buildings, excepting sheds not exceeding three hundred square feet in area shall not be built nearer than one foot to any line of the lot upon which they are built, street and alley lines excepted, except as hereinafter provided. It shall not be lawful to erect a frame building wider than forty feet nor deeper than seventy feet, unless such building be divided by a fire wall or fire walls, built of incombustible material and of a thickness of not less than four inches and of construction to be approved by the Commissioner of Buildings, so that no more than two thousand eight hundred square feet of superficial area shall be contained in any section or part of such building, uninclosed by such fire wall, and if openings are inserted in such fire walls, then such walls shall be built of brick not less than eight inches thick, and such openings shall have doors as described in Section 573. Each section of such buildings shall be regarded as a separate building for the purpose of determining the number and construction of its stairways and means of egress. If more than one frame building is built in the direction of the depth of any one lot, such buildings shall not be built with a less distance than ten feet between them, except where both buildings are used for living purposes, and in that case the distance shall be governed by Sections 439 and 440 of this chapter.

*661. **Sheds—Open Shelter—Height of Walls and Foundations—Enclosed.)** (a) Except as hereinafter provided, open shelter sheds not exceeding eight hundred square feet in area *not exceeding fourteen feet in height from the ground* may be erected within the fire limits, provided they have roofing of incombustible material and the highest point is not over fifteen feet above the ground, and provided that the roofs be supported on sufficient posts or piers; provided, however, that such sheds may be built with an area not to exceed sixteen hundred square feet, if they are kept at least twenty-five feet from any lot line and any other building or structure. Such sheds shall have no combustible enclosing walls or wooden floors, except that a floor of two-inch planking laid directly upon the ground may be used. Such sheds shall only be erected upon the rear of the lot, and not more than one such shelter shed or any other shed shall be erected on any lot of twenty-five feet in width.

(d) Sheds not exceeding fourteen feet in height from the ground to the highest point thereof, and not exceeding three hundred square feet in area, with an incombustible roof, may be constructed of wood within the fire limits. Such sheds shall not be located on the front part of any lot, nor shall they be used as a dwelling or as an addition to a dwelling house, or for any business purpose whatever, nor shall more than one shed be erected on any one building lot of twenty-five feet in width.

(b) If it is desired to enclose an open shelter shed, the enclosing walls shall be made of brick, hollow tile, or other incom-

bustible material, and such walls shall have foundations extending to solid ground and at least four feet below the surface of the ground.

(c) Open shelter sheds may be erected outside the fire limits not to exceed twenty-eight hundred square feet in area and subject to the approval of the Commissioner of Buildings; provided, however, that shelter sheds which comply in other respects with the requirements of this section, may be built not to exceed nine thousand square feet in area where such sheds are located at least twenty feet distant from any other structure and from any lot line.

*Amended and Par. (d) (new) added February 20, 1911.

662. **Sheds—Coal, Brick, Stone, Cement and Salt Sheds and Sheds for Icing Cars Along Railroad Tracks and Navigable Streams.)** Open shelter sheds to be used for the storage or handling of coal, brick, stone, cement, salt or such commodities which are incombustible, or for the icing of cars, may be erected within or without the fire limits upon, along or adjacent to steam railroad tracks, or along or adjacent to navigable waters; provided, such sheds shall have incombustible roofing and shall not exceed 35 feet in height from the ground to the highest point of the roof; provided, further, that said sheds shall be located at least 25 feet distant from any other structure and from any side lot line. If it is desired or intended to enclose any such sheds, the enclosing walls shall be of incombustible material. No such shed shall be built upon any lot or parcel of ground fronting upon any street within 75 feet of any building used exclusively for residence purposes, unless the consent of the owners of the majority of the frontage on both sides of such street between the two nearest intersecting cross streets shall first have been obtained by the person, firm or corporation desiring to erect and maintain such shed, and said written consents shall be filed with the Commissioner of Buildings before a permit shall be issued for such shed.

*663 **Ice Houses.)** *(a) Houses within the fire limits to be used exclusively for the storage of ice, not exceeding forty-five feet in height, and of a floor area not exceeding 9,000 square feet, may be constructed of wood with incombustible roofing, the walls to be enclosed with an envelope of incombustible material; eight-inch walls of brick or tile or approved cement concrete with proper foundations of masonry shall be used for such envelopes.*

*Amended February 20, 1911.

(b) Houses to be used exclusively for the storage of ice, located outside of the fire limits and contiguous to any lake and six hundred feet from any other building, except buildings used in connection with the conduct of said business, may be constructed of frame with incombustible roofing, and the floor area of any such building shall not exceed eighty thousand square feet, unless the building is divided by a solid wall of masonry for each additional 80,000 square feet of floor area, or fractional part thereof; and shall extend at each end not less than one foot beyond the enclosure of said building and such wall shall be subject to the approval of the Commissioner of Buildings.

(c) Houses to be used exclusively for the storage of ice, located outside of the fire limits, and contiguous to railroad tracks and not within one hundred feet of any other building, may be constructed of frame with incombustible roofing, and the floor area of any such building shall not exceed 20,000 square feet unless the building is divided by a solid wall of masonry for each additional 20,000 square feet of floor area or fractional part thereof; said wall shall extend at least one foot beyond the enclosure of said building on each end and shall be approved by the Department of Buildings.

(d) All dividing walls must extend through and above the roof of any building in which they are built to a distance of three feet and must be covered with incombustible coping. No dividing wall shall be of less thickness than twelve inches at any point thereof.

*664. **Lumber Yards—Not to be Located Near Residence Except by Consent.)** No person or corporation shall establish, maintain, conduct or operate *within the fire limits of the city as the same are now or may hereafter be defined by ordinance,* any lumber yard or place where new or second hand lumber is kept for sale or is stored for seasoning or drying on any premises fronting on any street in any block where two-thirds of the buildings on any street surrounding any such block are used exclusively for residence purposes, unless the written consent of the owners of a majority of the frontage on both sides of all the streets surrounding the block in which it is proposed to locate, establish, conduct or maintain such lumber yard or place, be first obtained by the person or corporation desiring to establish, maintain or operate such lumber yard or place, consenting to the issuance of a permit from the Department of Buildings, and also consenting that a license for the establishment, keeping or maintenance of such lumber yard or place shall be issued by the city. Such written consent shall accompany the application for a license and building permit made by such person or corporation.

*Amended May 6, 1912.

*665. **Storage of Lumber Near Planing Mill or Private Residence, Tenement House or Hotel.)** No lumber shall be piled *within the fire limits of the city as the same are now or may hereafter be defined by ordinance,* for the purpose of storing, seasoning or drying the same, within fifty feet of any planing mill or woodworking manufactory, nor within one hundred feet of any private residence, tenement house or hotel, unless the same has been erected since the establishment of such yard.

*Amended February 24, 1913.

(NOTE: Repealed March 30, 1914, and Section 309 of Fire Prevention and Public Safety Ordinance, passed in lieu.)

ARTICLE XVIII.

Stairways.

666. **Stairways, Number—Location—Construction.)** (a) Fireproof office buildings existing at the time of the passage of this ordinance which are equipped either with one stairway and two or more stairway fire escapes or with two stairways and one or more stairway fire escapes, shall not be required to have additional stairways or stairway fire escapes.

(b) Except as otherwise expressly provided in this Article, it shall be unlawful to construct or maintain any building or structure of Classes I, II and VII unless its stairway or stairways comply with the following provisions:

(c) In every existing building of ordinary construction having an area greater than 9,000 square feet or of mill or slow-burning construction greater than 12,000 square feet, there shall be not less than three stairways. The width of stairs shall be at least eighty per cent of the width of stairs as computed by the formulæ given herein and in no case less than twelve feet.

(d) Every building shall have at least one stairway from the ground to the top floor and one stairway from the lowest basement or cellar to the street grade, and no stairway shall be less than three feet in width.

(e) The width of stairs required for a building shall be constructed as the total width of all stairways required on the building. Stairs shall be measured between the wall and handrail for a single stair and between handrails where two or more handrails are required by this chapter.

(f) In buildings of Class I and Class IIa the width of stairs and fire escapes required for a building shall be determined by the floor area measured on the third floor of the building and such area shall not include walls, columns, stairs, elevator shafts, well holes, chimneys and corridors. In all cases where the building is less than three stories in height the width of stairs shall be determined by the floor area of the second floor as hereinafter specified.

*667. **Stairs—Number and Width of in Classes I, II and VII.)** (a) In buildings of Class IIb, Class IIc and Class VII the number and width of the stairs and fire escapes shall be determined by the area of that portion of the third floor not occupied by walls, columns, stairs, elevator shafts and well-holes.

In buildings of Class I, II and VII the number and width of stairs required shall be as follows:

(b) In Ordinary Construction.

With floor area of 5,000 square feet or less, two stairways;

With floor area of 5,000 to 9,000 square feet, three stairways.

Provided, however, that in buildings of ordinary construction, existing prior to December 5, 1910, with floor area of 5,000 square feet or less, one stairway only shall be required where the building is also equipped with an outside stairway fire escape, and in all such buildings with floor area of from 5,000 to 9,000 square feet, two stairways only shall be required; provided such building is also equipped with an outside stairway fire escape.

*Amended July 22, 1912.

(c) The width of stairs required in buildings of ordinary construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in square feet and multiplying the remainder by twelve and dividing the product by 1,000 and adding 72 inches to the quotient, expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}—3000) \text{ times } 12}{1{,}000}$$

(d) In Mill or Slow-Burning Construction.

With floor area of 6,000 square feet or less, two stairways.

With floor area of 6,000 to 12,000 square feet, three stairways.

(e) The width of stairs required in buildings of mill or slow-burning construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in feet and multiplying the remainder by eight and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}—3{,}000) \text{ times } 8}{1{,}000}$$

(f) In Fireproof Construction.

With floor area of 7,000 square feet or less, two stairways.

With floor area of 7,000 to 15,000 square feet, three stairways.

With floor area of 15,000 to 21,000 square feet, four stairways.

With floor area of 21,000 square feet and over, five stairways.

(g) Provided, however, that in fireproof buildings having an area of 21,000 square feet or more only four stairways shall be required if such building is completely equipped with an approved automatic sprinkler system.

(h) The width of stairs required in buildings of fireproof construction shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in feet and multiplying the remainder by six and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}—3{,}000) \text{ times } 6}{1{,}000}$$

(i) Provided, however, that where buildings of Class I are of fireproof construction and are used solely for storage warehouse purposes and the number of persons employed on any one floor does not exceed the number specified hereafter in this section they shall comply as to number of stairways as follows:

With floor area less than 8,000 square feet where not more than ten persons are employed on a floor, two stairways.

With floor area greater than 8,000 square feet and less than 15,000 square feet where not more than fifteen persons are employed on a floor, three stairways.

With floor area greater than 15,000 square feet where not more than twenty persons are employed on a floor, four stairways.

(j) The width of stairs shall be computed as follows:

The width of stairs in inches shall be equal to the result obtained by deducting 3,000 from the floor area of the building in feet and multiplying the remainder by four and dividing the product by 1,000, and adding 72 inches to the quotient; expressed in the formula as follows:

$$72 \text{ inches plus } \frac{(\text{area}—3{,}000) \text{ times } 4}{1000}$$

*668. **Stairs—Other Requirements.)** (a) The width of stairway fire escapes and three-quarters of the width of sliding fire escapes required by this chapter may be deducted from the width of stairs required.

(b) Stairways shall be located as far from each other as practicable. The bottom of each stairway shall be in the immediate vicinity of the top of the stairs leading to the next lower story and the line of travel from stairway to stairway shall be direct and easily accessible each to the other. At least one stairway shall extend to the roof of every building. In Classes I, II and VII, the whole number of stairways required for each building shall be complete in every respect from the first to the topmost story.

(c) Every story below the street grade shall have not less than two stairways to the first story and each such stairway shall be not less than three feet wide, but where a basement or cellar is used for the retail sale of goods the stairway from such basement or cellar shall in number and aggregate width comply with the requirement of this section for the first four stories above sidewalk grade.

(d) Where two areas of the same building adjoin and are separated by fireproof dividing walls they may have a stairway in common, provided such stairway is not less than five feet wide and is inclosed in all stories of the building by fireproof walls in non-fireproof buildings and by fireproof partitions in fireproof buildings; and where the stairways and landings are built as required by this chapter for buildings of fireproof construction, and where the doors,

frames, sashes and casings, and the glazed portion thereof are built as described in Sections 572 and 573 then in such case such stairway may be considered as equivalent to one open stairway from each such area, and where such stairway provides exit from only one floor area such stairway may be considered as equivalent to two open stairways but in no case shall there be less than two stairways in any such building except as otherwise provided in this chapter.

(e) Where adjoining buildings or buildings on opposite sides of an alley or other open space, and of the same class, used by the same person, firm or corporation, are connected by fireproof bridges or passageways with fireproof doors at each end, or by fireproof doors on each floor built and equipped as required by this chapter for dividing wall doors if such bridge or passageway or fireproof door is located as far as practicable from the stairways in both said buildings, then said bridge or passageway or fireproof door may be considered to be equivalent to a stairway for each of the two areas.

(f) *In buildings of classes I, II and VII, where an interior stair-way is enclosed in a tower and built as required by the provisions of Section 669 paragraph (n) of this Chapter, then such stairway shall be considered the equivalent of two stairways, or a stair-way and a fire-escape; provided, however, that if such stair-way is considered the equivalent of two stair-ways the building must be equipped with a stair-way fire-escape, or fire-escapes, as is required by this Chapter.*

*Amended December 4, 1911.

(g) Exterior stairways in buildings of Class I, II and VII built entirely of steel and iron, having ice-proof treads not less than ten inches wide from nosing to riser and a riser of eight inches or less for each riser, and otherwise made as required for stairway fire escapes in this chapter and where such stairway fire escape extends from the inside grade to the top floor of the building or is supplied from the second floor to the ground with a counterbalanced section and has a steel ladder from the top landing to the roof, then such stairway may be considered the equivalent of one interior stairway and one stairway fire escape if the width of such stairway and that of the one or more stairways in the building equals the width of stairs required by this chapter; provided, that in such case the respective floors, door sills, and stairway platforms are flush, and that the doors do not obstruct the stairs or platforms and that the doors are each at least 90 per cent of the width of said stairway and that the windows, doors and frames passed by such stairway and platforms are built of incombustible material and wired glass.

(h) In buildings of Class I not more than three stories in height, a stairway fire escape not less than three feet wide located and built as required by this chapter for such fire escape and placed as far as practicable from the stairway, may be considered as a stairway and may be deducted from the "width of stairs" required for the building.

(i) The width of different stairways need not be alike, and for each four stories or fractional number of stories of the building above the first four stories each stairway may be reduced six inches, but no stair in a Class VII building shall be less than three feet in width.

(j) Stairways which are less than three feet three inches wide shall have not less than one hand rail and stairways which are more than three feet three inches wide shall have not less than two handrails. Stairways which are over eight feet wide shall have double intermediate handrails with end newel posts at least five and a half feet high.

(k) Stairways hereafter erected shall not be spiral stairways or have any winders. Provided, however, that circular or elliptical stairways may be used if the width of treads one foot from the center of the handrail next to the well-hole is nine and one-half inches, including nosings.

(l) Stairways shall not have risers more than eight inches high nor treads less than ten inches wide, inclusive of nosings.

(m) The bottom of any counter-balance stairway or ladder fire escape hereafter erected on any public thoroughfare when raised shall be not less than fourteen feet above the pavement or surface of the street or alley.

(n) The location of every stairway required by this article shall be subject to the approval of the Commissioner of Buildings.

ARTICLE XIX.

Fire Escapes.

669. **Fire Escapes—Number and Location.)** (a) It shall be unlawful for any person, firm or corporation to construct or maintain any building of Classes I, II, III, VI, and VII within the city, unless the same shall be equipped with fire escapes as follows:

(b) Every building four or more stories in height, except such as is used exclusively for a residence for one family shall have one or more incombustible sliding or stairway fire escapes, as required by this chapter, except as otherwise herein provided.

(c) There shall be at least one stairway fire escape constructed as required by the provisions of this chapter for each 250 persons, or fractional part thereof, who occupy any floor of any building habitually and daily or for whom working, sleeping or living accommodations are provided on any one floor above the third floor of any building or structure.

(d) Buildings of Ordinary Construction Shall be Equipped with Fire Escapes as Follows:

With floor area of 6,500 square feet or less, one 24-inch stairway fire escape.

With floor area of 6,500 square feet to 9,000 square feet, two 24-inch stairway fire escapes.

(e) Buildings of Mill or Slow-Burning Construction Shall be Equipped with Fire Escapes as Follows:

With floor area of 8,000 square feet or less, one 24-inch stairway fire escape.

With floor area of 8,000 square feet to 12,000 square feet, two 24-inch stairway fire escapes.

(f) Buildings of Fireproof Construction Shall by Equipped with Fire Escapes as Follows:

With floor area of 10,000 square feet or less, one 24-inch stairway fire escape.

With floor area of 10,000 to 20,000 square feet, two 24-inch stairway fire escapes.

With floor area of more than 20,000 square feet, three 24-inch stairway fire escapes.

(g) Fireproof Warehouse Buildings Shall be Equipped with Fire Escapes as Follows:

With floor area of 12,000 square feet or less, one 24-inch stairway fire escape.

With floor area exceeding 12,000 square feet, two 24-inch stairway fire escapes.

(h) A fireproof bridge built as described in Section 668 and connecting each floor of two neighboring buildings occupied by the same person, firm or corporation, shall be considered the equivalent of a fire escape, or of an interior stairway, but not the equivalent of both.

(i) In buildings of Class II there shall be a stairway or a fire escape as near as practicable to the end of each corridor, and where a corridor is endless the stairs and the fire escapes shall be located around and

connected to said hall or corridor at distances approximately equal to each other.

(j) The openings leading to fire escapes on hospitals shall be flush with the floor leading to the fire escape which may be inclined not more than 2½ inches vertical to 12 inches of horizontal measurement, and shall be constructed and maintained with no obstructions thereon.

(k) In buildings hereafter erected wherever stairway fire escapes are considered the equivalent of an interior stairway or as taking the place of any of the "Width of Stairs" required by this chapter, there shall be a door or casement window leading to such fire escape from each floor. Windows and doors to such fire escapes shall not be less than 24 inches in width and not less than 72 inches in height. The sill of such windows or doors shall not be more than 24 inches above the floor, unless a stair is built leading to the same.

(l) Where a building is divided into separate areas, each such area shall be considered as a separate building and shall be equipped with stairs and fire escapes as is required for buildings by this chapter, unless otherwise herein provided.

(m) Exterior stairway fire escapes built as required by this chapter and having treads not less than 10 inches wide from nosing to riser and risers not more than 8 inches in height and having stairways extending from the inside grade to the top floor of the building or having a counterbalance section from the first story to the ground and a steel ladder from the top landing to the roof, shall be considered the equivalent of one interior stairway and one stairway fire escape, if the width of such stairway fire escapes with that of one or more stairways in the building equals the "Width of Stairs" required for the area of the respective buildings by this chapter.

**(n) Where a Fire Shield Stairway is constructed according to the following provisions and requirements, such Fire Shield Stairway shall be considered the equivalent of a stairway or stairways or a fire escape and stairway or stairways combined, as per the provisions of Paragraph "f" of this section.*

The Fire Shield Stairway shall be divided or separated from the building by, and completely enclosed with, brick walls or walls of fireproof material not less than twelve inches thick, or by a wall of reinforced concrete and tile in combination not less than ten inches thick subject to the approval of the Commissioner of Buildings. The walls of said Fire Shield Stairway are to be built from the lowest floor level to and at least thirty-six inches above the roof, except as otherwise herein provided. The roof of said Fire Shield Stairway shall be built of fireproof construction. The stairs of said Fire Shield Stairway shall be of fireproof construction, and all door openings must be provided with fireproof thresholds, metal frames and approved incombustible doors. The risers of all stairs shall be not more than eight inches and the tread not less than nine inches, and winders in stairs shall not be permitted. The nearest riser of the stair in a downward direction must be remote from the entrance to the Fire Shield Stairway a distance not less than the width of the stairs. The entrance to the Fire Shield Stairway shall be by a fireproof vestibule or by an outside balcony. Said balcony shall be constructed on private property and shall not encroach on or overhang a public street or alley. Said vestibule or balcony shall be not less than five feet wide and the floors, ceiling and sides thereof shall be of fireproof material. One side of said Fire Shield Stairway shall face a street or alley or an open space leading directly to and connecting with a public street or alley. The side of said vestibule facing the street, alley or other open space, shall be open for the full width thereof from a point four feet above the floor to the underside of ceiling in each story.

The open space above said wall may be enclosed by a fire shield in the following manner only:

A metal frame constructed of steel of commercial shape, or a sheet metal frame filled with concrete, with a horizontal cross piece midway between the top and bottom of said frame, may be fitted in the opening flush with the inside face of the wall. This frame may be hung with two sashes, sash to be of metal and glazed with fire-resisting glass, hinged at the bottom and arranged to open out from the top, and restrained by angle iron or chain attached to the inner part of jambs of the opening, so as to allow sash to rest on same in an open position, in such a manner that the top edge of sash will be flush with the outer face of the wall. The mason work at the head of the wall opening shall be beveled off at an angle of forty-five degrees. The opening and closing of these sashes are to be controlled by a mechanical device to be approved by the Commissioner of Buildings.

Where sash exceed five feet in width, intermediate piers of masonry sixteen inches wide by the breadth of wall in thickness may be built, and the resulting openings shall be each treated as hereinbefore stated.

All metal sash and fire-resisting glass installed shall be subject to specifications and requirements elsewhere contained in this ordinance.

The entrance from the building into the Fire Shield Stairway shall be through the vestibule or by means of the balcony only. All openings from the building to the balcony or vestibule and from the balcony or vestibule to the Fire Shield Stairway shall be not less than six feet nor more than seven feet in height and not less than four feet in width, and shall be provided with approved incombustible doors hung in metal frames and may be glazed with fire-resisting glass. In all cases, the floor of the vestibule or balcony, or floor landing of stairs, and the floor of the building containing Fire Shield Stairway shall be at the same level.

Where balconies are used as a means of access from the building to the Fire Shield Stairway, the floors of same shall be solid and built of fireproof material, and shall be of sufficient strength to sustain a load of one hundred pounds per square foot within the safe limits of stress for materials, as elsewhere specified in this chapter. Said balcony on each story shall be provided on the open side with an incombustible enclosure four feet high. There shall be a sufficient number of windows in the wall between the vestibule and stairway, or the doors to stairway shall be fitted with fire-resisting glass of sufficient area to properly light the said Fire Shield Stairway. All said window openings to be equipped with metal frames and sash and fire-resisting glass. The entire stairway, vestibule and balconies on all floors shall be provided with adequate means of illumination by gas or electricity on a separate circuit, and shall be lighted during all the time any part of the building in which they are located is being used after sunset or whenever lighting shall be required. The Fire Shield Stairway shall terminate at a landing on a level with, or not to exceed six inches above the street, alley or other open space on which said Fire Shield Stairway faces; and access from said landing to said street, alley or other open space, shall be direct by means of an incombustible door or doors equipped with a metal frame and fire-resisting glass, not less than six feet nor more than seven feet in height, and not less than four feet in width. Connection to said Fire Shield Stairway from first floor will not be required if first floor has sufficient exits properly located. All doors to Fire Shield Stairway shall be of the style known as "double acting doors." In buildings other than skeleton construction a slip joint must be provided in the masonry walls between the tower and any wall connecting or abutting thereto, subject to the approval of the Commissioner of Buildings.

Plans in detail, showing the construction and equipment and all other features of a Fire Shield Stairway shall be submitted in addition to the general plan showing the proposed location of same. Such details shall be drawn to an enlarged scale, and shall consist of a typical floor plan, a typical elevation and cross section of one or more stories and other stories which deviate from typical plan,

and shall be approved by the Commissioner of Buildings before a permit for construction of same is issued.

*Amended March 30, 1914.

(o) In buildings not more than two stories in height one stairway may be omitted if the building is equipped with a three-foot stairway fire escape built as required for fire escapes in this section with counterbalance drop and placed as far as practicable from the remaining stairway.

(p) Where fireproof buildings have a frontage upon public alleys or have courts of an area of not less than 320 square feet, and where such courts lead directly to a public thoroughfare, fire escapes may be permitted to be erected on such courts or such alleys and shall not be required to be erected upon the street fronts of such buildings. Such fire escapes shall be located as far as possible from stairways in the buildings, and where it is possible to erect the fire escapes on an alley or in a court they may be thus erected subject to the approval of the Commissioner of Buildings.

(q) In fireproof buildings of Class IIa, fire escapes may be located in light courts of fifty feet in the least dimension, having no opening onto a street or alley, but such fire escape must be connected with a stairway of the building at a level no higher than twenty-five feet above finished grade at the building, said stairway to terminate at the first floor level in a public corridor, giving direct egress from the building.

(r) Such fire escapes shall not be considered as part of the width of stairs as defined in Section 666 of this chapter for such buildings unless that portion of the stairway used in connection with the fire escape is increased by the width of the fire escape, from their junction to the ground.

Hospitals two or more stories in height shall be provided with one or more stairway fire escapes not less than 40 inches between handrails. Sliding fire escapes shall have a radius or witdth of not less than 42 inches. Sliding fire escapes shall not be built on public thoroughfares and shall deposit the person from same not more than twenty-four inches from the surrounding ground, and sliding fire escapes on Class VIII buildings shall be constructed, located and maintained in accordance with the provisions relating to Class VIII.

Wherever stairway fire escapes are considered by this chapter to be the equivalent of an interior stairway or as taking the place of any of the width of stairs, there shall be a door leading to said fire escape from each floor. Such door shall not be less than 24 inches in width and not less than 72 inches in height. The sill of such door shall not be more than 24 inches above the floor and the door shall be as wide as the stairway required on the fire escape. Where the sill is more than 24 inches from the floor, a small stairway shall be built from the floor to the window sill with treads not less than 10 inches wide and risers not more than 9 inches in height.

(s) A stairway fire escape placed on an exterior wall adjacent to a dividing or party wall shall be considered as a stairway fire escape for each building area to which it is adjacent. In such cases there shall be at least one door or window from each building area leading to the fire escape platform, and the width of each such fire escape shall not be less than 36 inches.

(t) All fire escapes shall be located and constructed to conform to the building for which they are respectively intended.

(u) If any building used wholly or in part for the purposes of Class VII be equipped with automatic sprinklers, and be connected with another building similarly used, and distant not less than twenty-five feet and used by the same occupant, by a fireproof bridge or passageway similarly equipped, then each such tier of bridges or passageways shall be held to be equivalent to and take the place of one outside stairway fire escape on each of the buildings so connected.

670. **Stairway Fire Escapes—Fees—Erection of — Location — Painting — Component Parts.)** (a) The Commissioner of Buildings and his assistants shall determine upon the location of all stairway fire escapes before erection of same is commenced.

(b) Before the work is commenced a permit shall be obtained from the Commissioner of Buildings for which a fee of $2.00 shall be exacted.

(c) No permit for a stairway fire escape more than twenty-four inches in width shall be granted unless a detailed plan for the fire escape, approved by a licensed architect or a structural engineer, is submitted to the Commissioner of Buildings, and a copy of such plans shall be left on file with said Commissioner.

(d) All anchors for stairway fire escapes shall, wherever possible, pass through the wall of building and be secured on inside of same. Where it is possible to anchor through walls, anchors shall be put in wall not less than fifteen inches at an angle of thirty-five degrees. On buildings of steel construction, where walls are less than twenty inches in thickness there shall be steel channels at least four inches wide set on inside of building from column to column and bolted or riveted to columns, and anchors shall be bolted on inside of channels.

(e) Anchors for a platform four feet two inches or less in width shall be made of one inch square iron; over four feet two inches and not over six feet, shall be one and one-fourth inch square iron, with brace; over six feet shall be one and one-half inch square iron with brace. All anchors shall be turned up not less than eight inches at the outside of the platform on which to bolt the post.

(f) Braces shall be the same thickness as the anchors. The spread of the braces shall be the width of the platform. Where the platforms are over five feet in width, anchors shall have double braces, one to the outside and one to the center of the platform.

(g) Platforms shall be not less than fifty inches wide at ends; passageways shall be not less than twenty-four inches between buildings and railings. Platforms shall be not less than five feet in length. The frames and crossbars shall be made as provided in this chapter. Platforms shall have clips at each end bolted to anchors. No door or window or shutter shall open so as to obstruct in any way the free passage on or along a platform or a stairway fire escape.

(h) All stairway fire escapes for apartment buildings, hotels, boarding houses, factories and office buildings, where there are less than 100 people on any one floor, shall be not less than two feet wide between hand rails. Stringers for a 24-inch stairway fire escape shall be not less than 2 inches by ⅜ inch set 1½ inches apart. Where stairway fire escapes and their balconies and supports are designed and constructed in accordance with the provisions of this chapter relating to materials permitted for such stairway fire escapes, balconies and supports, so as to sustain a load of 100 pounds per square foot, they may be built of steel channels, angles, or I-beams, but when so constructed, they shall comply with the provisions of this chapter in all other respects. All stairway fire escapes for halls, churches, theaters, hospitals, schools, department stores and buildings where large numbers

of people congregate shall not be less than three feet wide in the clear, and all passageways shall not be less than three feet wide in the clear. Stringers for a 36-inch stairway fire escape shall be made of two bars, 3 inches by $\frac{5}{16}$ inch, about one inch apart, or $4\frac{1}{2}$ inches by $\frac{3}{8}$ inch flat iron, or of steel channels, angles or I-beams; where over 12 feet in length, they shall have anchor and brace in the center. The tread shall be made of one-half inch square steel or iron, corner upwards, not to exceed $1\frac{5}{8}$ inches center, riveted at ends to 2 by $\frac{1}{16}$ inch flat iron or steel. There shall be not less than four bars to a tread where treads are less than twenty-seven inches in length; where treads are over twenty-seven inches in length there shall be not less than six bars to a tread; there shall be a truss supporting treads made of bar iron 2 inches by $\frac{3}{8}$ inches in thickness, riveted to bars of treads in center, supported by not less than two inches by seven-sixteenths inch rods bolted at each end of treads. All stairs shall have an incline of about forty-five degrees. The rise shall be not more than nine inches and the tread not less than nine inches.

(i) All stairs shall have three bar railings made of one-inch bar iron for top rail, and three-fourths inch bar iron for lower rail, and when such stairs are more than three inches from the wall of the building, there shall be one or more hand rails on the wall side of such stairs.

(j) All posts used for stair fire escapes shall be made of one and one-half inch angle or channel iron not less than three feet six inches high measured at right angles with the treads of such fire escapes, and shall have braces on the outside turned upwards and fastened to the frame of the balcony or stairs, which shall be not less than half way up the posts; all stair fire escapes shall extend to the ground, either by counterbalance drop or stairs. All ladder fire escapes shall have either extension ladder or counterbalance drop from the first story of said building to the ground or sidewalk. Their location, material and construction shall be subject to the approval of the Commissioner of Buildings. Where cables are used for counterbalance stairs they shall not be less than three-quarters of an inch in size and shall be well oiled or greased when hung up and shall be oiled or greased at least twice a year. All pulleys and cables holding counterbalance drop shall be covered at bracket so as to be protected from snow or ice.

(k) Wherever a stairway fire escape passes a window or door on buildings hereafter erected, the windows or doors shall be of wired glass and shall have metal frames and sash, and whenever such a fire escape passes above a window, door or other opening not fitted with wired glass and metal frames the said fire escape shall be protected on the under side by sheet metal of not less than No. 20 United States gauge opposite such opening and for a distance of three feet on each side thereof. The use of intermediate platforms shall be permitted on all buildings now built or hereafter constructed whenever it is possible by their use to avoid the necessity of stairway fire escapes passing windows. All fire escapes shall be painted with two coats of mineral paint when erected, one at the shop and one upon completion at the building, and they shall be painted at least once every year thereafter.

(l) Wherever it is impossible to erect stairway fire escapes according to the provisions of this chapter, plans shall be submitted to the Commissioner of Buildings showing the location, material and construction of such stairway fire escapes as are proposed to be built before a permit is issued for the same, and if it is found to be impracticable to locate and construct fire escapes in accordance with the provisions of this chapter and that fire escapes built according to the plan presented would afford safe and practical means of exit from the building on which they are to be placed, then the Commissioner of Buildings may in his discretion approve the same. All such fire escapes shall be inspected by the Commissioner of Buildings on their completion and if found to be safe, satisfactory and in compliance with said approved plans, a certificate shall be issued to such effect upon the payment of $2.00 to the City Collector. All fire escapes other than such as it is impossible or impracticable to build in accordance with the provisions of this chapter shall be inspected by the Commissioner of Buildings on their completion, and if found to be in compliance with the provisions of this chapter a certificate shall be issued by the Commissioner of Buildings upon the payment of a fee of $2.00 to the City Collector.

(m) It shall be unlawful for any person, firm or corporation to use any building until the provisions of this article shall have been complied with.

671. **Ladder Fire Escapes—When Permitted.)** Where a building of Class III or VI, not more than four stories in height has two flights of stairs leading from the ground to the top floor of the building and where also each occupant shall have access to at least two separate and distinct stairways located as required by the provision of this chapter from the top floor to the ground, a ladder fire escape may be used in lieu of the stairway fire escape required herein, where a counter balance drop is placed from the ladder fire escape to the ground.

*672. **Specifications for Ladder Fire Escapes.)** (a) All single and double ladder fire escapes hereafter erected shall be in strict accordance with the following provisions:

(b) There shall be not less than three one-inch square wrought iron anchors to every five-foot balcony and not less than six for a twelve-foot balcony. Such anchors shall pass through the wall of the building and be bolted on the inside with a three-fourths by two-inch nut and three and one-half inch iron washer back of the nut, where the wall is not over twenty inches thick; but where the wall is over twenty inches thick anchors shall be inserted at least eight inches into the wall at an angle of thirty-five degrees.

(c) Where a ladder fire escape is permitted by this chapter, the side guards shall be two by three-eighths inch flat iron. All ladder fire escapes shall be seventeen inches or more in width in the clear. No . . . pipe nor rusted or defective material shall be used in the construction of ladder fire escapes. Rungs of ladders shall be of not less than one-half-inch square iron with corners upward, so as to give a safe footing. Rungs shall be riveted and shall be constructed with fourteen-inch centers.

*Amended February 20, 1911.

(d) The brace for the anchors shall be at least twenty inches spread and shall extend into the wall four inches; no other form of anchor shall be allowed except by special permit from the Commissioner of Buildings.

673. **Balconies—Construction of.)** All balconies hereafter erected shall be either steel or wrought iron and capable of sustaining a weight of one hundred pounds to the square foot. The balcony frame shall be made of not less than two-inch by two-inch by one-fourth inch angle iron which shall be securely riveted together with crossbars every two feet. Such bars shall be

punched one-half inch square close to the top of the bar on two inch centers and one-half inch square iron bars shall be forced through the same. The crossbars shall be securely riveted to the angle iron frame. The crossbars for a balcony twenty-eight inches wide shall be two inch by three-eighths inch. Balcony frames over twenty-eight inches wide shall be made of not less than two by three-eighths inch iron and made to conform with the increased dimensions of iron in crossbars; for thirty-six inch balcony or more they shall be two and one-half inch by three-eighths inch. All balconies over this width shall have a two-inch "T" iron through the center of the balcony for the bars to rest upon; provided that such balconies and platforms of buildings of Class IIc may be built as described in Section 268 of this chapter. Such balconies shall have a substantial cast or wrought iron post every three feet bolted to the balcony. No balcony shall have less than three guard rails which shall be of wrought iron or new iron pipe not less than three-fourths inch in diameter and the ends shall be securely anchored to the wall of the building and shall be not less than ten inches on an angle of thirty-five degrees. Where stairway fire escapes and their balconies are designed and constructed in accordance with the provisions of this chapter to sustain a load of one hundred pounds per square foot, they may be built of steel channel angles or I-beams, but in such cases they shall comply with the requirements of this chapter in all other respects.

674. **Standpipes—Pumps—Axes, Etc., and Fire Fighting Apparatus.)** (a) In every building one hundred feet or more in height not provided with a three-inch or larger inside standpipe and in all buildings hereafter constructed of a greater height than seventy-five feet excepting buildings used for the purposes of Class IIc and Class V as herein elsewhere provided for, and in all buildings of a greater height than five stories now or hereafter used for hotels or public lodging house purposes, there shall be installed one or more four-inch standpipes, which shall extend from the basement to the roof and which shall be connected at the outside of the street or alley side of the building with a Siamese connection provided with iron cap for use of the fire department, and which shall be provided with one hose connection, with fire department thread, on the roof of said building, on each floor and in the basement thereof, with sufficient hose attached to reach any point thereof. The pattern, quality, installation and maintenance of such standpipe, hose and couplings, shall be subject to the approval of the Fire Marshal.

(b) In any of the buildings herein referred to which are completely equipped with an approved automatic sprinkler system it shall not be necessary to install inside standpipes as above provided for.

675. **Grain Elevators, Malt Houses and Cold Storage Houses—Steamer Connections—Sprinkler System.)** The interior of all grain elevators and malt houses of a height of fifty or more feet which are not of fireproof construction, and which have a capacity of two hundred and fifty thousand bushels or over; and the interior of all cold storage houses of a height of four or more stories which are not of fireproof construction and which have a ground floor area of ten thousand or more square feet, shall be completely equipped with either a dry or wet approved automatic sprinkler system with a feeder or riser pipe or pipes not less than four inches in diameter, leading from one or more Siamese steamer connections provided with iron caps, all of which shall be installed and maintained subject to the approval of the Fire Marshal.

676. **Grain Elevators, Malt Houses and Cold Storage Houses—Watch Service.)** (a) Grain elevators which are equipped with an approved fire alarm system, properly maintained; or grain elevators, malt houses and cold storage houses which are now equipped with standpipes and hose of approved quality, and which have outside standpipes not less than 2½ inches in diameter, and Siamese steamer connections properly located; and which are equipped with fire extinguishers, water barrels and pails distributed at proper intervals on all floors; and where some approved electric watch service and fire alarm system is maintained, and a watchman is employed to pull such stations at least once an hour every day and night of the year, all of which shall be subject to the approval of the Fire Marshal, will not be required to install additional inside standpipes as provided in the foregoing sections.

(b) It shall be unlawful for any person, firm or corporation to erect, use or maintain any building as a grain elevator, malt house or cold storage house unless such building complies with all the provisions of this section, or unless the Fire Marshal has such building examined and certifies to the Commissioner of Buildings that such building complies in all respects with the provisions of this section, and each day's unlawful use of such building, as above provided, shall be considered a separate offense.

677. **Steamer Siamese Connections.)** There shall be a Siamese connection at the bottom of each standpipe, so that two steam fire engines may be attached to it without interfering with each other. Such Siamese connection shall be within easy reaching distance from the sidewalk and be securely anchored to the wall of the building. The owner, agent, occupant or person in possession, charge or control of the premises where such standpipe and Siamese connection are located, is hereby required to provide such covering or protection as is provided for in Sections 674 and 675 to the fittings of said Siamese connection for the purpose of keeping said fittings and connection clear and unobstructed. The protection or covering herein referred to shall apply to all inside and outside standpipes and connections to automatic sprinkler equipment now in existence or hereafter installed.

678. **Fire Escapes—Signs Indicating Location.)** Every building required to be equipped with metallic ladder fire escapes and wrought iron or steel balconies, sliding or stairway fire escapes, or other fire escape devices, shall have displayed in conspicuous places, on each floor of such building, notices sufficient in number and in plainly legible type at least six inches in height, indicating and showing the location of such fire escapes and the easiest way to reach them. If such notices be not displayed within thirty days after such equipment is installed and kept continuously displayed the Commissioner of Buildings shall cause the building to be closed and kept closed until the provisions of this section shall have been complied with.

679. **Stairs and Fire Escapes—Obstruction, Change in Construction.)** It shall be unlawful under any circumstances to close up or obstruct any stairways or fire escapes of any buildings or the approaches leading thereto. No change in the position or construction of any such stairway or fire escape shall be made, unless the permission of the Commissioner of Buildings shall first have been obtained.

ARTICLE XX.

Ventilation.

680. **Ventilation in Buildings of Classes IV, V, VII and VIII.)** (a) The air in any room used as an auditorium in buildings of Class IV and V, hereafter erected and the air in any room used as a classroom or assembly hall in buildings of Class VIII, hereafter erected, shall be changed, so as to provide each person for whom seating accommodation is provided in such auditorium, classroom or assembly hall with at least 1,500 cubic feet of air per hour.

(b) In buildings of Class VII, hereafter erected, on floors frequented by the public the air in such rooms shall be supplied at the following rates:

For each person in basement, 2,000 cubic feet per hour.

For each person in 1st to 3rd stories, both inclusive, 1,500 cubic feet per hour.

For each person in 4th story and above, except as hereinafter provided, 1,300 cubic feet per hour.

For each person in grocery departments and restaurants, 1,500 cubic feet per hour.

(c) For the purpose of determining the number of people on any floor in buildings of Class VII, in calculating the means of ventilation, the following floor area per person per floor shall be taken as the basis:

Basement, per person, 20 square feet of floor area exclusive of walls, stairs and elevators.

First story, per person, 20 square feet of floor area, exclusive of walls, stairs, elevators, and enclosed show windows.

Second story, per person, 50 square feet of floor area, exclusive of walls, stairs, elevators, and enclosed show windows.

Third story, per person, 60 square feet of floor area, exclusive of walls, stairs and elevators.

Fourth story and above per person, 80 square feet of floor area, exclusive of walls, stairs and elevators, except as hereinafter provided.

(d) Grocery departments and restaurants, per person, 40 square feet of floor area, exclusive of walls, stairs and elevators.

(e) The amount of carbon dioxide in the air of any such auditorium, classroom or assembly hall or space frequented by the public in Class VII buildings shall not be permitted to rise above 10 parts of carbon dioxide per 10,000 parts of air, measurements being taken at levels from two and one-half feet to eight feet above the floor, generally distributed, and the temperature in such spaces when artifically heated shall not exceed 68 degrees Fahrenheit. Relative humidity shall not be less than 45 degrees nor more than 80 degrees.

(f) The air in any room used as an auditorium in buildings of Classes IV and V, constructed prior to the passage of this ordinance, and the air in any room used as a classroom or assembly hall in buildings of Class VIII, constructed prior to the passage of this ordinance, shall be changed, so as to provide each person for whom seating accommodation is provided in such auditorium, classroom or assembly hall with at least 1,200 cubic feet of air per hour.

(g) The air in any rooms and floors in buildings of Class VII, erected prior to the passage of this ordinance, shall be supplied, by mechanical or other means, at the following rates:

For each person in basement, 1,600 cubic feet per hour.

For each person in 1st to 3rd stories, both inclusive, 1,200 cubic feet per hour.

For each person in 4th story and above, except as hereinafter provided, 1,040 cubic feet per hour.

For each person in grocery departments and restaurants, 1,200 cubic feet per hour.

(h) For the purpose of determining the number of people on any floor in buildings of Class VII, in calculating the means of ventilation, the following floor area per person per floor shall be taken as the basis:

Basement, per person, 20 square feet of floor area exclusive of walls, stairs and elevators.

First story, per person, 20 square feet of floor area exclusive of walls, stairs, elevators, and enclosed show windows.

Second story, per person, 50 square feet of floor area exclusive of walls, stairs, elevators, and enclosed show windows.

Third story, per person, 60 square feet of floor area exclusive of walls, stairs and elevators.

Fourth story and above, per person, 80 square feet of floor area exclusive of walls, stairs and elevators, except as hereinafter provided.

Grocery departments and restaurants, per person, 40 square feet of floor area exclusive of walls, stairs and elevators.

(i) The amount of carbon dioxide in the air of any such auditorium, classroom or assembly hall or space frequented by the public in Class VII buildings shall not be permitted to rise above 12 parts of carbon dioxide per 10,000 parts of air, measurements being taken at levels from two and one-half feet to eight feet above the floor generally distributed; and the temperature in such spaces when artificially heated shall not exceed 70 degrees Fahrenheit. The relative humidity shall not be less than 40 degrees nor more than 85 degrees.

(j) The word "auditorium" as used in this section in connection with buildings of Classes IV and V shall be construed as including the main floor, balcony and galleries.

(k) In buildings hereafter erected for or converted to the use of a factory, mill or workshop, the air shall be changed, except as hereinafter provided, so as to provide each person for whom working accommodations are provided therein with at least 1,500 cubic feet of air per hour.

(l) In buildings used for the purposes of a factory, mill or workshop at the time of the passage of this ordinance, the air shall be changed, except as hereinafter provided, so as to provide each person for whom working accommodations are provided therein with at least 1,200 cubic feet of air per hour.

(m) In any building or room hereafter erected for or converted to the use of a factory, mill or workshop the amount of carbon dioxide in the air, except as hereinafter provided, shall not be permitted to rise above ten parts of carbon dioxide per 10,000 parts of air.

(n) In buildings or rooms used for the purpose of a factory, mill or workshop at the time of the passage of this ordinance, the amount of carbon dioxide in the air, except as hereinafter provided, shall not be permitted to rise above twelve parts of carbon dioxide per 10,000 parts of air. The measurements in each case above enumerated in this paragraph shall be taken at levels from two and one-half feet to eight feet above the floor, distributed generally; and the temperature in such spaces, when artificially heated, shall not exceed 68 degrees Fahrenheit, except as hereinafter provided; the relative humidity shall not be less than 40 degrees nor more than 85 degrees.

(o) The above provisions and standards as to ventilation shall not apply to storage rooms or vaults or any place where the manufacturing processes therein conducted would be materially interfered with, or where manufacturing processes therein conducted would produce considerable quantities of free carbon dioxide, except that the air

in such rooms or vaults or in any places of manufacture shall not be permitted to become detrimental to the health of those who enter or work therein.

(p) No part of the fresh air supplied in compliance with the requirements of this section shall be taken from any cellar or basement.

(q) No person, firm or corporation, either as owner, proprietor, lessee, manager or superintendent of any factory, mill, workshop or any other building where one or more persons are employed, shall cause, permit or allow the same or any portion or apartment of any room in such factory, mill or workshop, to be overcrowded or to have inadequate, faulty or insufficient light or ventilation.

(r) No person shall be exposed to any direct draft from any air inlet, nor to any draft having a temperature of less than sixty degrees.

(s) All poisonous or noxious fumes or gases arising from any process, and all dust of a character injurious to the health of the persons employed, which is created in the course of a manufacturing process, within such factory, mill, workshop or laundry, shall be removed, as far as practicable, by either ventilating or exhaust devices.

ARTICLE XXI.

Elevators and Their Enclosing Walls.

681. **Elevators—Passenger and Freight—Permit for Construction—Fee—Penalty.)** (a) Before proceeding with the construction or alteration of any passenger or freight elevator, except such as are hereinafter specially exempted from the provisions of this chapter, a permit for such construction or alteration shall be obtained from the Commissioner of Buildings either by the owner or agent of the building in which such elevator is to be constructed or in which such alterations are to be made, or by the contractor who is about to construct or alter such elevator.

(b) It shall be unlawful for any such owner, agent, or contractor to permit or allow the construction of any such elevator or the making of such alterations, or to proceed with or in or about any of the work of construction or alteration of any such elevator until such permit shall first have been obtained. Such permit shall be issued by the Commissioner of Buildings after application shall have been made to him therefor by any such owner, agent or contractor, specifying the number and kind of elevators which it is desired to construct, or the nature of the alternations to be made and the location of the building or structure in which the same is or are to be placed or made. Such application shall be accompanied with such plans and specifications as shall be necessary to advise and inform said Commissioner of the plan of construction, type of elevator, kind of alterations and the location thereof. If such plans and specifications shall show that such elevator or elevators is or are to be constructed or erected or altered in conformity with the provisions of this chapter, the Commissioner shall approve the same and shall issue a permit to such applicant upon the payment of such applicant of a fee of two dollars for each elevator to be constructed, erected or altered, and such fee shall be known as a permit fee and shall not be held to cover the cost of any inspection which shall at any time thereafter be made of such elevator or elevators when constructed, or of any alterations made.

(c) All contractors or persons, firms, or corporations, engaged in the manufacture and work of installing iron doors on passenger or freight elevators, or of installing wire work enclosures around elevators shall secure a permit from the Commissioner of Buildings for the work on each such elevator, the fee for which shall be two dollars for each elevator.

(d) It shall be unlawful for any person, firm or corporation either as owner, lessee, contractor or agent of any building or structure in which any elevator or elevators are to be constructed or altered to proceed with said work without securing a permit as herein required for such construction or alteration, and no such permit shall be issued until such person, firm or corporation, lessee, contractor or agent shall have complied with all the requirements of this chapter.

682. **Enclosure of Elevator Shafts in Non-Fireproof Buildings.)** In all non-fireproof buildings hereafter erected all passenger elevators and all freight elevators, except such as are expressly excepted by this chapter, shall be inclosed in a wall of brick, tile or such incombustible material as may, from time to time, be approved by the Commissioner of Buildings as proper and suitable for the purpose; such inclosure shall extend from the foundation to the roof of such building, and shall be supported independently of the floor construction; provided, further, however, that the provisions of this section shall not apply to any non-fireproof building which is equipped throughout on every floor and in every room thereof and in all stairways, platforms, elevator shafts, elevator hoistways and well holes with an automatic sprinkler system approved by the Fire Marshal.

683. **Enclosure of Pits and Shafts in Basements.)** In all buildings heretofore or hereafter erected, whenever any elevator shaft extends down into a basement or subbasement, that portion thereof extending below the street level shall be inclosed in walls of brick, tile or other fireproof material, and the door openings in such inclosure shall be protected by incombustible doors. Where such elevator shafts do not extend down into the basement they shall be provided with fireproof pits at the lowermost floor level above which they serve, and such pits shall have no openings except for cables or other elevator equipment.

684. **Enclosure of Dumb Water Shafts—Materials.)** In all non-fireproof buildings hereafter erected, the dumb waiter shafts shall be inclosed with brick, tile, reinforced concrete, or cement plaster not less than two inches thick or metal studs and lath.

685. **Doors—On Elevators.)** In all elevator shafts which are herein required to be enclosed with fireproof walls, the door openings shall be equipped with doors of incombustible material, which shall be made to open from the outside by means of a key or other device satisfactory to the Commissioner of Buildings.

686. **Hatch Doors—Freight Elevators.)** Elevators, used exclusively as freight elevators constructed and in operation at the time of the passage of this ordinance need not have enclosing walls, but in all such cases there shall be at every floor through which such freight elevators pass automatic hatch closers or automatic doors, made in such manner that they will fully close each well hole when the temperature in such well hole exceeds 140 degrees Fahrenheit; and it shall be the duty of the owner, agent or person in possession, charge or control of a building in which such elevator is maintained to keep such hatch closers or doors at all times in good working order. Such automatic hatch closers shall be examined by the Commissioner of Buildings and the Fire Marshal and if said officials shall find that such doors will automatically close when the temperature at or near such doors exceeds 140 degrees Fahrenheit, and that the conditions of construction and operation of such doors or hatch closers are such that there is no reasonable probability of their

getting out of order and failing to operate when required, and that in their construction or operation there is nothing that is likely to cause accidents to or interference with the elevator service in such hatch holes which they were intended to close, and that the building in which such freight elevator is in use is equipped with stairways, fire escapes and passenger elevators sufficient to offer ample means of escape from such building in case of fire, for all persons employed or for all persons in such building, then, and in such case only, shall the use of such hatch doors or closers be permitted. All freight elevators in non-fireproof buildings shall comply with the preceding requirements of this section, or shall have inclosing walls of incombustible or fireproof construction. Such elevators are to be inspected semi-annually and oftener when, in the opinion of the Commissioner of Buildings, such inspection is necessary and such fees shall be paid for said inspection as otherwise provided in said chapter.

*687. **Safety Device.)** (a) Every passenger and freight elevator now in operation or hereafter installed, except such as are hereinafter exempted from the provisions of this chapter, shall be provided with a speed governor and such other efficient device to secure the safe operation of such passenger or freight elevator, and to prevent the cab or car of such elevator from falling, and to secure the safety of the cab or car and its load in case it does fail, as may be required by the Commissioner of Buildings. Such speed governor and other devices shall be subjected to such a practical test as may be determined by the Commissioner of Buildings for the purpose of ascertaining the efficiency of such safety device.

(b) It shall be the duty of the Commissioner of Buildings to make such test of each and every device upon all elevators, and no elevator shall be permitted to be run until such test has been made.

(c) That whenever any accident shall occur causing injury to any person affecting life or limb, in or about an elevator, or while getting on or off an elevator, or in any way impairing the safety of the elevator, the same shall be reported at once by the owner, superintendent, lessee or manager of the building, or the operator of the elevator, to the Comsioner of Buildings. No broken or damaged part of such elevator shall be moved or displaced, or repairs made thereon, nor shall said elevator be operated until an investigation into such accident has been made by the Commissioner of Buildings or his duly authorized agent. A full report in writing of the result of each investigation shall be filed in the Department of Buildings, and the Commissioner of Buildings shall keep a complete record of all such accidents and reports thereon.

(d) It shall be unlawful for any operator of any elevator in the City of Chicago wherein passengers are conveyed to start such elevator until all doors of such elevator and leading into such elevator shall be closed. It shall be unlawful for any such operator to open the doors of such elevator until said elevator has come to a full stop.

(e) Any person violating any of the provisions of this section shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense.

*Amended (by adding paragraphs (c), (d) and (e)) April 28, 1913.

*688. **Safeguards for Elevators.)** (a) Where the counterweights travel in the same hatchway with an elevator car, the portion of the car contiguous to the weights shall be protected from the top to the bottom of the car by a suitable guard.

(b) All freight elevators shall be provided with a guard at least six feet high. All elevator cabs or cars, whether used for freight or passengers, shall be provided with some device whereby the car or cab may be held in the event of accident to the shipper rope or hoisting machinery or controlling apparatus.

(c) No passenger elevator hereafter erected shall be installed with a freight compartment either below or above the car.

(d) All hoistways, hatchways, elevator wells and wheel holes in any building, whether occupied or vacant, shall be securely fenced, inclosed or otherwise safely protected, and it shall be the duty of the owner, occupant or agent of any such building to keep all such means of protection closed at all times, except when it is necessary to have the same open, in order that the said hatchways, elevators or hoisting apparatus may be used.

*Amended February 2, 1914.

(e) It shall be unlawful to erect or maintain an elevator where such elevator or its counterweight descends into any passageway or thoroughfare.

(f) There shall be directly under the sheaves at the top of every elevator hatchway, a grating of steel or heavy wire mesh properly supported by steel or iron and capable of sustaining a load of not less than 500 pounds.

(g) All counterweights hereafter installed shall have their component parts so fastened together as to provent any piece or pieces from becoming detached from the guides should the counterweights be accidentally drawn to the top of the hatchway.

(h) Where drum counterweight cables run through or pass by the car counterweights to weights underneath, they shall be provided with a suitable covering to prevent their chafing and wearing on the counterweights.

(i) Where elevators other than handhoists and sidewalk elevators are not inclosed with fireproof or incombustible material, as is elsewhere herein specified in this Article, the well-hole of such elevator shall be enclosed with a wire guard not less than six feet high. The counterweights and the immediate space through which they travel must be protected from the floor to the ceiling with a wire guard or with other incombustible material. There must be on all elevators hereafter constructed a clear space of not less than two feet between the bottom of the hatchway and the level of the lower floor landing when the car is at its lowest position, and there must be a clearance of at least four feet from the top of the crossbeam of the car to the lower side of the grating under the overhead sheaves. Whenever there is conflict in regard to the manner of enclosing any elevator shaft or portion thereof between this section and Sections 682, 683 and 684, the provisions of the latter sections shall prevail.

(j) All passenger and freight elevators hereafter installed, except sidewalk or hand elevators, shall have an artificial traveling gas or electric light attached to the car and maintained in good working condition.

(k) All power driven elevtors hereafter constructed or installed shall have at least two hoisting cables for the cage and two cables for each counterweight. The lifting and counterweight cables shall have at least one full turn of the cable on the drum when the car has run its limit.

(l) It shall be unlawful to change a hand-hoist to a power-driven elevator without first making application to the Commissioner of Buildings for a permit for such change, and it shall be unlawful to connect an electric motor or any other appliance to the hand elevator machinery without the approval of the Commissioner of Buildings.

(m) All elevators, except hand elevators operated by a pulley rope and sidewalk ram or chain hoist elevators, and elevators used in tunnels for freight service only, shall be equipped with a safety speed governor.

(n) Where ropes or cables are used to operate safety devices, a weight shall be

properly attached to the same in such a manner as to insure the necessary tension on such rope or cables for proper performance of the safety devices.

(o) All elevators propelled by electricity shall be provided with an additional device not operated by a link belt or sprocket chain which will automatically stop the elevator machinery when the car has reached its limit of travel. It shall be unlawful to construct or maintain any elevator equipped with a sprocket chain or link belt device or devices connecting the operating device and controller.

(p) An emergency switch which will disconnect the current shall be provided in all passenger elevators hereafter installed which are operated by an electric controller car switch, and such cars shall be so constructed that they will automatically stop when the current is disconnected.

(q) The underside of the floors or other parts of a building which project into passenger elevator shafts shall be equipped with a smooth steel guard curved and sloped from the enclosure of said elevator to the edge of such projection for the width of the door to such elevator car and the slope of the guard plate shall not be less than sixty degrees with the horizon.

(r) The provisions of this section requiring the equipment of elevators with safety devices shall not apply to any hand hoists, elevator or hoist used solely for hoisting materials or tools in any building in course of construction, but the Commissioner of Buildings shall make such reasonable requirements as he may deem necessary for public safety in the operation of such hand hoists, elevators or hoists used solely for hoisting materials or tools in such buildings while under construction.

689. **Inspection—Test—Certificate to Be Posted.)** (a) Every elevator now in operation or which may be hereafter installed, together with the hoistway and all equipment thereof, shall be inspected under and by the authority of the Commissioner of Buildings at least once every six months, and in no case shall any new elevator be placed in operation until an inspection of the same has been made.

(b) It shall be the duty of every owner or agent, lessee or occupant of any building wherein any elevator is installed and the person in charge or control of any elevator to permit the making of a test and inspection of such elevator or elevators and all devices used in connection therewith upon demand being made by the Commissioner of Buildings or by a duly authorized Elevator Inspector within five days after such demand has been made.

(c) Whenever any such elevator has been inspected and the tests herein required shall have been made of all safety devices with which such elevator is required to be equipped and the result of such inspection and tests shows such elevator to be in good condition, satisfactory to the Commissioner of Buildings, and that such safety devices have been provided in accordance with the requirements of this chapter and are in good working condition and in good repair, it shall be the duty of the Commissioner of Buildings to issue or cause to be issued a certificate setting forth the result of such inspection and tests and containing the date of inspection, the weight which the elevator will safely carry and a statement to the effect that the shaft doors, hoistway and all equipment, including safety devices, are constructed in accordance with the provisions of this chapter, upon the payment of the inspection fee required by this chapter.

(d) It shall be the joint duty of the owner, agent, lessee or occupant of the building in which such elevator is located and of each person in charge or control of such elevator to frame the certificate and place same in a conspicuous place in each elevator.

(e) The words "safe condition" in this section shall mean that it is safe for any load up to the amount of weight named in such certificate.

(f) Where the result of such inspection or tests shall show such elevator to be in an unsafe condition or in bad repair, or shall show that the safety devices, or any of them, which are required by this chapter, have not been installed, or if installed, are not in good working order or not in good repair, such certificate shall not be issued until such elevator, its hoistway and its equipment or such device or devices shall have been put in good working order, satisfactory to the Commissioner of Buildings. The inspection fees herein required shall be paid either at the time application is made for inspection or upon the completion of such inspection and tests.

690. **Power of Commissioner to Stop Operation of Elevators.)** (a) Whenever any building or elevator inspector finds any passenger or freight elevator or any of its running parts or automatic devices or other equipment out of order, or in an unsafe condition, he shall immediately report the same to the Commissioner of Buildings, together with a statement of all the facts relating to the condition of such elevator or elevators.

(b) It shall be the duty of the Commissioner of Buildings upon receiving from any inspector a report of the unsafe condition of any elevator, to order and cause such elevator not to be used until the same shall have been placed in a safe condition, and it shall be unlawful for any owner, agent, lessee, or occupant of any building, wherein any such passenger or freight elevator is located within the city, to permit or allow any such elevator to be used after the receipt of a notice in writing from the Commissioner of Buildings that any such elevator is out of order or is in an unsafe condition and until said elevator has been put in a safe and proper condition as required by the provisions of this chapter.

ARTICLE XXII.

Storage of Oils.

*691. **Construction of Buildings for Storage of Oils Prohibited—Exceptions.)** (a) It shall be unlawful for any person, firm or corporation to build, construct or erect any building designed for the storage of crude, petroleum, gasoline, naphtha, benzine, camphine, carbon oil, *tar or any compound thereof*, spirit gas, burning fluid, spirits of turpentine, coal oil, rock oil, earth oil, or any other liquid, except such as will stand a test of one hundred and fifty degrees Fahrenheit, according to the method of John Tagliabue: *provided, however, that no such building shall hereafter be constructed within three hundred feet of any building used in whole or in part for residence purposes.*

*Amended August 14, 1912.

(b) Buildings heretofore erected designed for the storage of the fluids mentioned in the preceding paragraph must conform to the following provisions:

(c) The walls shall be of brick, stone or concrete, and shall be not less than sixteen inches thick or more than sixteen feet high. The lower floor of such buildings shall be at least three feet below the grade of the adjoining street and shall be made of earth, concrete, or brick. The roof of such buildings shall be made of tile, metal or other incombustible material, and the outside walls of any such buildings having a flat roof shall extend at least eighteen inches above the roof. The coping upon the roof of such buildings shall be made of incombustible material. Such buildings shall be detached

from all other buildings and shall be properly ventilated. Where any such building shall be located less than twenty-five feet away from any other building or structure, the wall or walls of such oil storage building on the side or sides thereof within such distance of twenty-five feet from any other building or structure shall have no windows or other opening therein; provided, however, that if such building cannot be so constructed that no outside wall thereof shall be less than twenty-five feet away from any other building or structure, in such case, openings may be made in the wall of such building which is located farthest away from any other building or structure for the purpose of admitting light or providing means of access thereto or egress therefrom. If such opening be a window, the glass in such window shall be fire-resisting glass in metal frame, and such window shall be provided with a steel shutter.

(d) No such building shall be occupied for any purpose other than the storage of oils, and no person shall be permitted to use any such building as a sleeping apartment or dwelling place.

(e) Such buildings and the equipment thereof, including the protection of the doors and windows, shall be constructed according to plans and specifications submitted to and approved by the Commissioner of Buildings.

*692. **Storage of Oils.)** (a) It shall be unlawful for any person, firm or corporation to keep or store crude petroleum, gasoline, naphtha, benzine, camphine, carbon oil, *tar or any compound thereof*, spirit gas, burning fluid, spirits of turpentine, coal oil, rock oil, earth oil, or any other liquid, except such as will stand a test of one hundred and fifty degrees Fahrenheit, according to the method of John Tagliabue, in any quantity exceeding ten gallons, upon or in any building, structure or premises, within the City of Chicago, except in such a building or structure as has been heretofore constructed in accordance with the provisions of Section 691, or in such tanks as are provided for in Section 693 of The Chicago Code of 1911.

*Amended August 14, 1912.

(b) Where ten gallons or less of any of the above-mentioned oils or fluids, except such as will stand the test above mentioned, are kept upon or in any building or structure within the city, they must be kept in safety cans made of not less than 24-gauge galvanized iron or other suitable metal approved by the Fire Marshal, with opening or openings protected by self-closing stops, and such safety cans must be of a type approved by the Fire Marshal.

(c) No gas, candle, oil or other like artificial light or lighted stove, gas grate or other open flame or electric switch or cut-out of any kind shall be allowed within fifteen feet of any receptacle or receptacles containing any of the oils or fluids mentioned in this Article, nor shall electric switches or cutouts be located closer than four feet to the floor in rooms containing such oils or fluids.

*693. **Tanks for Storage of Oils.)** (a) Any person, firm or corporation desiring to use any space underneath the surface of the ground, or underneath any building in the City of Chicago, except in such a building or structure as was formerly authorized under the provisions of Section 691 of this Article, for the construction, maintenance or use of any tank thereunder for the storage of any one or more of the oils or fluids mentioned in Section 692, shall first obtain a permit so to do from the Commissioner of Buildings of the City of Chicago, and the applicant shall pay to the City Collector a fee of two dollars ($2.00) for each tank prior to the issuance of such permit, which fee shall cover the cost of the inspection thereof, and no such permit shall be issued without first being approved by the Fire Marshal of the City of Chicago, and said permit may be revoked by the Mayor at any time for a just cause.

(b) Applications for such permits shall be in writing, stating specifically the location, the space desired to be used, the length, breadth and depth, together with the measurement in feet from the surface of the ground to the top of such tank and shall contain the plans and specifications for the construction of said tank, its connections, fittings, openings and safety appliances: *Provided, however, that whenever application is made to construct any such tank or tanks in any block or square in which two-thirds of the property according to frontage on both sides of the street is used exclusively for residence purposes, such application shall be accompanied by the written consent of a majority of the property owners according to frontage in such block or square before a permit shall issue. This provision shall not be applicable to the construction of a tank or tanks to be used in connection with a private garage.*

*Amended April 14, 1913.

(c) Tanks for the underground storage of the oils or fluids mentioned in Section 692 with the exceptions therein provided shall be made of galvanized steel, open hearth basic steel or wrought iron of a gauge depending upon the capacity, as follows: 14 U. S. gauge for capacities of 180 gallons or less; 12 U. S. gauge for capacities of 181 to 300 gallons; 7 U. S. gauge for capacities of 301 to 4,000 gallons; one-fourth inch with three-eighths inch heads for capacities of 4,001 to 10,000 gallons; three-eighths inch for capacities of 10,001 to 12,600 gallons. All portions of such tanks shall be either riveted, and soldered or caulked, or welded or brazed together and made oil tight and shall be coated on the outside with tar asphaltum or other rust-resisting material. Every such tank exceeding 4,000 gallons in capacity shall have a manhole.

(d) Tanks (other than portable filling tanks hereinafter mentioned, those located in buildings heretofore constructed under the provisions of Section 691 of this article and those located beneath or attached to buildings as hereinafter provided in this section) shall be placed and maintained with the tops at least two feet under the surface of the ground and shall have no building or structure of any kind over or above them. When located not less than two hundred feet away from any building or structure or from any street, alley or public way, dock, water front, lumber yard or any yard or place where combustible materials are kept or stored, such tanks shall contain not to exceed twelve thousand six hundred gallons each, and when located less than two hundred feet away from any building or other structure or from any street, alley or public way, dock, water front, lumber yard or any yard or place where combustible materials are kept or stored, shall contain not to exceed one thousand gallons each; provided, however, that the aggregate capacity of tanks located within thirty feet of any building shall not exceed five thousand gallons. No such tank shall * * * be connected either directly or indirectly with any public or private sewer, drain or catch basin in the City of Chicago *unless an approved oil separator is provided, or unless such tank in and of itself, or together with its fittings, is capable of performing the functions of an oil separator, and so installed as to prevent the discharge of any of the liquids mentioned in Section No. 692 into said sewers, drain or catch basin.* All pipes leading to or from such tanks shall be of galvanized wrought iron with heavy galvanized cast-iron or brass fittings, protected against injury, and shall be so placed that the tops of such tanks shall be lower than the level of the lowest pipe in the building used in connection therewith, and all such tanks shall be so placed that no artificial

light shall be required while filling. Each tank shall be provided with a filler pipe of galvanized iron or brass, not less than one and one-quarter inches in diameter, entering at the top of the tank and extending not less than four inches below the top of the tank, the upper end of which said filler pipe shall terminate in a locked screw cap or metal filler box, which must be kept securely locked at all times, except when such tank is being filled, and each such tank, *unless hydraulically operated, shall have a vent pipe so arranged that the filler pipe cannot be opened without opening the vent pipe unless a permanently open vent pipe is used, in which case such vent pipe shall be not less than one inch in diameter and shall be carried up to the outer air and terminate in a weatherproof hood. The tops of all fill pipes and vent pipes shall be provided with a brass screen of not less than thirty mesh to the inch. Tanks located inside of building walls, or within ten feet thereof, must have permanently open vent pipes, which shall be carried up ten feet above the roof of the building to which they are attached and terminate at least twenty feet from all openings in adjacent buildings. Where vent pipes are located at the surface of the ground, they shall terminate in a locked screw cap, or other device, which shall be approved by the Fire Marshal. Fill and vent pipes shall be so located as not to create exposure to openings in any building.* The installation of said tanks shall be subject to the supervision and approval of the Fire Marshal of the City of Chicago and they shall not be covered up until the said Fire Marshal has inspected them and found that the tanks and their equipment comply with the provisions of this section and until said Fire Marshal has issued to the owner thereof a certificate to that effect.

(e) Tanks for the storage of one or more of the oils or fluids mentioned in Section 692 of an aggregate capacity of not more than three hundred gallons, may be installed beneath buildings. Every such tank shall be enclosed by a casing of concrete at least six inches in thickness and shall be so situated and constructed that the top of such tank shall be at least two feet below the upper surface of the lowest floor, which shall be constructed of concrete not less than six inches thick. The filling pipes of tanks installed underneath buildings as provided in this paragraph must terminate outside of the outer wall of said building in a locked screw cap or other device of a design which shall be approved by the Fire Marshal of the City of Chicago, and said screw cap or device must be kept securely locked at all times except when such tank is being filled, and where any such filler pipe runs to a sidewalk, alley or public highway it must terminate in a locked screw cap or other device of a design which shall be approved by the said Fire Marshal and which shall be set flush with the surface of the sidewalk, alley or highway, and provided with a locked iron cover, which must be kept securely locked at all times except when such tank is being filled. The filling pipe and the vent pipe of any such tank must be laid underneath the concrete floor of the building until they reach the outside of the outer wall of said building. Such tanks shall comply in all other respects with the provisions, conditions and requirements of the preceding paragraphs of this section; provided, however, that no such tank shall be constructed underneath any building any part of which is used for residence, hotel or lodging purposes. Such tanks must be supplied with pumps or other devices for the removal of the contents thereof which shall have been approved by the Fire Marshal of the City of Chicago. Each pipe connecting such tank with the pump or the device for the removal of its contents shall be of galvanized iron and must be so laid that no portion thereof is lower than its level at the point where such pipe is connected with the tank, and it shall be pitched upward from the tank to the pump or other device used for the removal of the contents of such tank, and said pipe shall be laid at least eighteen inches below the surface of the ground, and all exposed portions thereof shall be properly protected.

(f) Sealed portable filling tanks of a capacity of not more than sixty gallons may be used inside of garages for the storage and handling of any one or more of the oils or fluids mentioned in Section 692. Such tanks shall be constructed of not less than No. 7 U. S. gauge steel, supported on steel wheels not less than thirty inches in diameter with rubber tires, and provided with an approved pump or other device for the removal of the contents thereof, and a hose, of length not to exceed eight feet, through which the oil or fluid is to flow.

(g) Pressure tanks not exceeding six gallons oil capacity, constructed of not less than No. 18 U. S. gauge steel, and used in connection with lighting systems, approved by the Fire Marshal, may be placed above ground and attached to the outside walls of buildings.

*Amended December 18, 1911.

694. **Oil Tanks Used in Connection With Engines; Gas Producers, Etc.)** (a) Tanks for storing oils or liquids which will stand a test of one hundred and fifty degrees Fahrenheit, according to the method of John Tagliabue, used in connection with engines, gas producers, furnaces, ovens or other oil burning equipments, must be constructed in accordance with the provisions of Section 693, and, if installed inside of buildings must be limited to an aggregate capacity of 1,000 gallons, and must be placed beneath the lowest floor in the manner specified for oils and fluids mentioned in Section 692; provided, however, that an auxiliary tank of a capacity not exceeding ten gallons may be placed above the floor.

(b) Nothing in the provisions of this Article shall be construed as repealing any of the provisions of an ordinance for the storage of gasoline in the alleys of the city, passed by the City Council on the 11th day of March, A. D. 1907, pages 3456 to 3461, inclusive, of the Council Proceedings of said date.

ARTICLE XXIII.

Billboards, Signboards, Signs, and Fences.

695. **Billboards and Signboards on Buildings—Construction—Height.)** No billboard or signboard shall be erected or placed upon or above the roof of any building or structure within the limits of the City of Chicago; and it shall be unlawful for any person, firm or corporation to attach any billboard or signboard to the front, sides, or rear walls of any building, unless the same shall be placed flat against the surface of the building and safely and securely anchored or fastened thereto in a manner satisfactory to the Commissioner of Buildings.

696. **Size and Construction of Billboards and Signboards Erected Within Fire Limits Otherwise Than on Buildings.)** The face of billboards or signboards erected within the fire limits as now defined or as they may hereafter be defined by ordinances of the City of Chicago other than signboards and billboards referred to in Section 698 hereof, shall not exceed twelve feet in height, and the same shall be constructed of galvanized iron or some other equally incombustible material, except that the stringers, uprights and braces thereof may be of wood. All such billboards or signboards shall be securely anchored or fastened so as to be safe and substantial.

697. **Height and Distance From the Ground of Billboards and Signboards Erected Within the Fire Limits.)** It shall be unlawful for any person, firm or corporation to construct or erect any billboard or sign-

board, except those specified in Section 698 hereof, within the fire limits of the City of Chicago at a greater height than fifteen feet six inches above the level of the adjoining street. Where the grade of the adjoining street or streets has not been established, no billboard or signboard shall be constructed or erected at a greater height than fifteen feet six inches above the level of the ground upon which such billboard or signboard is erected. The face of every billboard or signboard within the fire limits shall be of incombustible material, but the supports and framework of the same shall be of wood. The base of the billboard or signboard shall, in all cases, be at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard or signboard is to be erected is above the level of the street, then the bottom of the face of the billboard or signboard must be at least three feet six inches above the level of the ground at the point where the board is to be erected. Every said billboard or signboard must be constructed and located in accordance with the provisions of this Article and shall be subject to the approval of the Commissioner of Buildings.

698. **Wooden Billboards or Signboards—Construction—Size—Exceptions.)** Billboards or signboards not exceeding twelve square feet in area may be built of wood or other combustible material, and such billboards or signboards shall be exempt from the provisions of this Article, except that they shall be safely and securely anchored or fastened and shall be so constructed, anchored and fastened that they will withstand the wind pressure specified in Section 703 of this Article. It shall be unlawful to erect any such square feet in area before a permit therefor has been procured from the Commissioner of Buildings, the application for which must include the plans and specifications of such board and its supports and fastenings. No such board or boards shall be more than twelve feet high.

699. **Billboards and Signboards Erected Outside the Fire Limits—Construction—Size.)** It shall be unlawful for any person, firm or corporation to construct, erect or locate any billboard or signboard, except those specified in Section 698 hereof, outside the fire limits of Chicago at a greater height than fifteen feet six inches above the level of the adjoining street. Where the grade of the adjoining street has not been established, no billboard or signboard shall be constructed or erected at a greater height than fifteen feet six inches above the level of the ground upon which such billboard or signboard is erected. The base of the billboard or signboard shall, in all cases, be at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard is to be erected is above the level of the street, then the bottom of the face of the billboard or signboard must be at least three feet six inches above the level of the ground at the point where the board is to be erected. The braces, supports and face of the billboard or signboard outside the fire limits may be made of wood, unless the billboard or signboard shall be erected or located so that any part of the face of said board is nearer than ten feet to any building or structure in which case the face of the same shall be constructed with incombustible material. Every such billboard or signboard shall be safely and securely constructed, anchored, fastened and located in accordance with the provisions of this article and shall be subject to the approval of the Commissioner of Buildings.

700. **Provisions of This Article Shall Apply to Other Similar Structures.)** The provisions of this article shall apply to other similar structures of like size and construction without regard to their use whether erected on or near the surface of the ground or anchored to, or fastened to any building or structure.

701. **No Billboard or Signboard Shall be Erected Without Permit.)** No billboard or signboard or other similar structure such as is described in this article shall be erected or maintained within the city unless a permit shall first have been secured by the person, firm or corporation desiring to erect or maintain such billboard or signboard from the Commissioner of Buildings to whom application for such permit shall be made; and such application shall be accompanied by such plans and specifications of the proposed billboard or signboard and location of same as are necessary to fully advise and acquaint the said Commissioner with the construction of such proposed billboard or signboard. If the plans and specifications accompanying such application shall be in accordance with the provisions of this article, said Commissioner shall thereupon issue a permit for the erection of such billboard or signboard upon the payment by the applicant of a fee as hereinafter fixed.

702. **Alteration and Repair of Billboards and Signboards.)** No material alteration of any billboard or signboard nor removal from one location to another shall be made except upon a written permit issued by the Commissioner of Buildings authorizing such alteration or removal; and such permit shall be issued upon application in writing made to such Commissioner by the owner of such billboard or signboard or by the person in charge, possession or control thereof, accompanied by a plan of the proposed alterations or repairs to be made and a written statement covering the proposed removal from one location to another and its reconstruction in the new location, which said alteration and repairs or removal shall be made in accordance with the provisions of this article and the ordinances of the City of Chicago. Where such plans, specifications and location are in compliance with the requirements of this article and are satisfactory to and approved by the Commissioner of Buildings, such Commissioner shall issue a permit upon the payment of a fee therefor as hereinafter fixed; but such alteration shall not be construed to apply to the changing of any advertising matter of any billboard or signboard, nor the refacing of the framework supporting same.

703. **Wind Pressure—Strength—Billboards Now Existing or Hereafter Constructed.)** All billboards and signboards now in existence, or hereafter to be constructed, erected or maintained, shall be made, constructed, erected and maintained of sufficient strength to withstand a wind pressure of twenty-five pounds per square foot of surface without stressing the material beyond the safe limit of stress given elsewhere in this chapter.

704. **Changes in Existing Billboards and Signboards.)** No surface billboard or signboard constructed or erected prior to the passage of this ordinance shall be maintained after six months from and after the passage of this ordinance where the height of such billboard or signboard exceeds seventeen feet, nor shall such billboard or signboard be maintained after such date, unless there is a clear space of at least three feet six inches above the level of the adjoining street. If, however, the level of the ground where the billboard or signboard is erected or maintained is above the level of the street then there must be a clear space of at least three feet between the bottom or face of the billboard or signboard and the level of the ground at the point where the billboard or signboard is erected or maintained.

705. **Duty of Commissioner—Owner's Name to Be Placed on Top of Billboard**

or Signboard—Annual Inspection.) It shall be the duty of the Commissioner of Buildings to inspect all plans and specifications submitted in connection with the erection or construction or the alteration or repair of any billboard or signboard and to approve same if the method of construction and provisions made for fastening, securing, anchoring and maintaining such billboard or signboards are such as will serve to protect the public and to render such billboards safe and substantial. It is further made the duty of the Commissioner of Buildings to exercise supervision over all billboards and signboards erected or being maintained under the provisions of this article: and to cause inspection by inspectors in his department of all such billboards and signboards to be made once each year and oftener where the condition of such boards so require; and whenever it shall appear to said Commissioner that any such billboard or signboard has been erected in violation of this ordinance or is in an unsafe condition or has become unstable or insecure or is in such a condition as to be a menace to the safety or health of the public, he shall thereupon issue or cause to be issued a notice in writing to the owner of such billboard or signboard or person in charge, possession or control thereof, if the whereabouts of such person is known, informing such person, firm or corporation of the violation of this ordinance and the dangerous condition of such billboard or signboard and directing him to make such alterations or repairs thereto, or to do such acts or things, as are necessary or advisable to place such billboard or signboard in a safe, substantial and secure condition and to make the same comply with the requirements of this ordinance within such reasonable time as may be stated in said notice. If the owner or person in charge, possession or control of any billboard or signboard when so notified shall refuse, fail, or neglect to comply with and conform to the requirements of such notice, said Commissioner shall, upon the expiration of the time therein mentioned, alter, change, tear down or cause to be torn down such part of such billboard or signboard as is constructed and maintained in violation of this ordinance, and shall charge the expense to the owner or person in possession, charge or control of such billboard or signboard which shall be recovered from them by appropriate legal proceedings. If the owner of such billboard or signboard or the person in charge, possession or control thereof cannot be found, or his or their whereabouts cannot be ascertained, the Commissioner shall attach or cause to be attached to said billboard or signboard, a notice of the same import as that required to be sent to the owner or person in charge, possession or control thereof, where the owner is known; and if such billboard or signboard shall not have been made to conform to this ordinance and be placed in a secure, safe and substanital condition, in accordance with the requirements of such notice, within thirty days after such notice shall have been attached to such billboard or signboard, it shall be the duty of the Commissioner of Buildings to thereupon cause such billboard or signboard or such portion thereof as is constructed and maintained in violation of this ordinance to be torn down; provided that nothing herein contained shall prevent the Commissioner of Buildings from adopting such precautionary measure as may be necessary or advisable in case of imminent danger in order to place such billboard or signboard in a safe condition, the expense of which shall be charged to and recovered from the owner of such billboard or signboard or person in charge, possession or control thereof in any appropriate proceedings therefor. No permit shall be issued to any applicant for permission to erect a billboard or signboard unless such applicant shall agree to place and maintain on the top of such billboard or signboard the name of the person or corporation owning same or who is in charge, possession or control thereof. It shall be the duty of the Commissioner of Buildings to require that the name of the person or corporation owning or in possession, charge or control of such billboard or signboard is placed upon such billboard or signboard forthwith upon the erection thereof and is kept thereon at all times such billboard or signboard is maintained; and in case the owner of such billboard or signboard or the person in charge, possession or control thereof shall fail or refuse to place and maintain such name on the same, they shall be subject to the penalty hereinafter provided for. Every person, firm or corporation engaged in the business of erecting billboards or signboards for the purpose of display advertising shall file with the Commissioner of Buildings within ninety days after the passage of this ordinance a full and complete report of the location and size of all existing billboards or signboards.

*706. **Fees for Permits and Annual Inspection—Indemnifying Bond.)** (a) The fee to be charged for permits issued for the erection or construction of billboards or signboards or for the alteration thereof shall be two dollars for each twenty-five lineal feet of billboard or signboard erected or altered. An annual inspection fee shall be charged every person, firm or corporation as owner, or in possession, charge or control of any billboard or signboard now in existence or hereafter to be erected, which shall be *one dollar* for each twenty-five lineal feet of billboard or signboard or fractional part thereof.

*Amended February 6, 1913.

(b) Every person, firm or corporation engaged in the business of constructing and erecting billboards or signboards shall file with the City Clerk a penal bond, with sureties to be approved by the Commissioner of Buildings, in the sum of twenty-five thousand ($25,000.00) dollars, conditioned that such person, firm or corporation shall faithfully comply with all the provisions and requirements of this ordinance with respect to the construction, alteration, location and safety of billboards or signboards and for the payment of the inspection fee required by said ordinance; and conditioned, further, to indemnify, save and keep harmless said City of Chicago and its officials from any and all claims, damages, liabilities, losses, actions, suits or judgments which may be presented, sustained, brought or secured against the City of Chicago or any of its officials on account of the construction, maintenance, alteration or removal of any of said billboards or signboards, or by reason of any accidents caused by or resulting therefrom.

707. **Frontage Consents Required.)** It shall be unlawful for any person, firm or corporation to erect or construct any billboard or signboard in any block on any public street in which one-half of the buildings on both sides of the street are used exclusively for residence purposes without first obtaining the consent in writing of the owners or duly authorized agents of said owners owning a majority of the frontage of the property on both sides of the street in the block in which such billboard or signboard is to be erected, constructed or located. Such written consents shall be filed with the Commissioner of Buildings before a permit shall be issued for the erection, construction or location of such billboard or signboard.

708. **Penalty.)** Any person, firm or corporation owning, operating, maintaining or in charge, possession or control of any billboard or signboard within the city, who shall

neglect or refuse to comply with the provisions of this article, or who erects, constructs or maintains any billboard or signboard that does not comply with the provisions of this article shall be fined not less than twenty-five ($25.00) dollars nor more than two hundred ($200.00) dollars for each offense; and each day on which any such person shall permit or allow any billboard or signboard owned, operated, maintained or controlled by him to be erected, constructed or maintained in violation of any of the provisions of this article shall constitute a separate and distinct offense.

*709. **Fences—***Walls***—Height of—***Wind Resistance.*) No wooden fence shall be constructed of greater height than eight feet above the sidewalk grade or eight feet above the surface of the ground where no grade is established. *No fence of any other material shall be constructed on a lot alongside a street or alley or within eight feet of such street or alley and parallel thereto of greater height than eight feet above the surface of the street or alley where a grade is established or eight feet above the surface of the street or alley where no grade is established. No single or isolated wall of any material whatever, which forms no part of a building or structure that may be lawfully erected, shall be constructed upon any portion of a lot where the distance from such wall to the lot line is less than the height of the wall, unless such isolated wall shall have lateral supports on at least one side of same with braces extending to the top of the wall and is so constructed that it shall be capable of resisting a horizontal wind pressure on every part of same twice as great as buildings under the provisions of this chapter must be designed to resist.*

In all cases where a fence or wall has been or shall hereafter be erected contrary to the provisions of this section, the Commissioner of Buildings shall forthwith notify the owner or agent of the land on which same is located, or the contractor engaged in erecting same, and shall specify briefly in such notice in what manner such fence or wall violates the provisions of this ordinance, and the said Commissioner of Buildings shall require the person so notified to forthwith make such fence or wall conform to and comply with the provisions of this ordinance, specifying in such notice the time within which such work shall be done.

If at the expiration of the time set forth in the notice provided for in this section, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and shall not have torn down or changed the said fence or wall so as to conform to and comply with the provisions of this ordinance, the Commissioner of Buildings shall have authority and it shall be his duty to proceed forthwith to tear down, or cause to be torn down, such fence or wall or so much thereof as is being maintained or shall have been erected and constructed in violation of the provisions of this section, and the cost of such tearing down shall be charged to and recovered from the owner of such fence or wall or from the person for whom such fence or wall has been or is being erected.

*Amended February 24, 1913.

710. **Illuminated and Other Roof Signs of Steel Skeleton Construction—Definition—General Requirements—Fees.)** (a) Illuminated and other roof signs regulated by this section shall be defined as signs constructed, erected and maintained upon or over the roof of any building, which have all or any part of its letters of which said signs may be constructed either in an outline of incandescent lamps or which have painted, flush or raised letters where the face of the sign presents a surface to be affected by wind pressure not in excess of the requirements hereinafter contained; or signs having a border of incandescent lights attached thereto and reflecting light thereon; or transparent glass signs where they are lighted by electricity or other illuminant. Every such sign as hereinabove described shall be constructed with steel skeleton construction so as to present a surface to be affected by wind pressure which shall not exceed fifty per cent. of the face of the sign. No illuminated roof sign shall be erected or maintained upon or over the roof of any building unless the framework thereof shall be entirely of metal or some other equally incombustible material, and no material, except such material as is used for insulating wires and conductors, which is less combustible than metal, shall be used in, on or about, or comprise a part of any illuminated roof sign, except that the material to which the framework of any such sign shall be anchored, may be substantial beams anchored or securely fastened to the roof or walls of the buildings upon or over which any such sign is erected.

(b) The distance between the roof of said building or structure and the lower edge of such sign shall not be less than five (5) feet. The height of any such sign from the roof of the building or structure to which the same is anchored or attached shall not exceed sixty (60) feet. No such sign, hereafter erected, shall be constructed closer than six (6) feet from the edge of the roof of the building or structure upon which same is erected. No such illuminated roof sign shall be constructed on any building or structure which is over eight stories in height. Any illuminated roof sign, less than twelve (12) feet in height, shall be exempt from the provisions of this section and shall be held to be governed by the ordinances of the City of Chicago relating to billboards and signboards. No illuminated roof sign, such as is described in this section, shall be constructed, erected, maintained or put in place until the person, firm or corporation desiring to construct, erect, maintain or put in place such sign shall have made application in writing to the Commissioner of Buildings for permission so to do, submitting with such application plans and specifications showing the size, nature and construction of the sign proposed to be erected, and shall present to the City Electrician plans showing the insulation, location and construction of the electrical part of such sign. If the Commissioner of Buildings shall be of the opinion that such sign, if erected, constructed and maintained in accordance with the plans and specifications so submitted, shall be safe and secure, he shall approve the application so submitted, providing the plans bear the approval of the City Electrician, and the Commissioner of Buildings shall note his approval upon such plans and specifications and keep a copy thereof at all times on file in his office. All signs shall be constructed, erected and maintained of sufficient strength to withstand a wind pressure of not less than thirty pounds per square foot of surface without stressing the material beyond the safe limits of stress given elsewhere in this chapter. It shall be the duty of the Commissioner of Buildings to cause his building inspector or inspectors to make an inspection annually of each illuminated roof sign erected or constructed or being maintained under the provisions of this ordinance for the purpose of ascertaining whether such sign is safely and securely constructed and so anchored and fastened to the building or structure; provided, however, that the provisions of this section shall not apply to the erection, construction and maintenance of signboards and billboards as regulated by the ordinances of the City of Chicago.

(c) Any person, firm or corporation desiring to erect or maintain an illuminated roof sign, as described in this ordinance, shall pay to the city, to cover the cost of the inspection and approval by the Commissioner of Buildings of the plans and specifications of such sign, when erected, a fee of fifty dollars ($50.00) for the first five hundred (500) square feet of superficial

area of such sign or fractional part thereof, and for each additional square foot two cents (2c). For each annual inspection by the Commissioner of Buildings subsequent to the first inspection there shall be paid a fee of fifty dollars ($50.00) for each illuminated roof sign. In addition to the fees herein required to be paid for inspection by the Commissioner of Buildings, there shall be paid by the owner or person having charge or control of any illuminated roof sign, as herein described, an annual inspection fee to cover the cost of such inspection which shall be made by the City Electrician, and such fee shall be at the rate provided by the ordinances of Chicago.

(d) Every illuminated roof sign erected, constructed or maintained under the provisions of this ordinance shall have the name of the owner thereof placed thereon in a legible and conspicuous manner. No person, firm or corporation shall be permitted to erect or maintain an illuminated roof sign unless he shall execute and file with the City Clerk of Chicago, with sureties to be approved by the Commissioner of Buildings, a bond to the City of Chicago in the penal sum of fifteen thousand dollars ($15,000.00), conditioned to indemnify, save and keep harmless the City of Chicago, and its officers and agents, from any damage which it, the said city, or any of said officers, may suffer, or from any costs, liability or expense of any kind whatsoever which it, the said city, or any of its officers, may be put to or which may be recovered against the said city, or any of its officers, from or by reason of the construction, erection and maintenance of such sign, and conditional further to faithfully observe and perform all the provisions and conditions of this ordinance and of any ordinance now in force or which may hereafter be passed by the City Council of the City of Chicago, relating to or governing the erection, maintenance, use or inspection of illuminated roof signs.

(e) The permission and authority granted by this ordinance shall cease at any time hereafter at the discretion of the Mayor. In case of the termination of the privileges herein granted by the exercise of the Mayor's discretion as aforesaid, all such electrical signs erected by virtue of the authority conferred by this ordinance, shall be removed at the expense of the owner or owners of the building or the person, firm, corporation or individual who are then maintaining same without any cost or expense of any kind whatsoever to the City of Chicago, provided that in the event of the failure, neglect or refusal on the part of the owner of the building or structure upon which said illuminated electric sign is constructed or the person, firm, corporation or individual operating and maintaining said electric sign to remove said electric sign upon the revocation of the permit by the Mayor as herein provided, the Commissioner of Buildings may proceed to remove same and charge the expense thereof to the owner of the building or structure upon which said illuminated electric sign is constructed or the person, firm, corporation or individual operating or maintaining same.

(f) Any person, firm or corporation who shall erect, construct or maintain an illuminated roof sign in violation of any of the provisions of this section shall be fined not less than fifty dollars ($50.00) nor more than two hundred dollars ($200.00) for each offense.

ARTICLE XXIV.
Frontage Consents.

711. **Definition of Word "Block" as Used in This Chapter.)** Whenever a provision is made in this chapter that frontage consents shall be obtained for the erection, construction, alteration, enlargement or maintenance of any building or structure in any block, the word "block," so used, shall not be held to mean a square, but shall be held to embrace only that part of a street bounding the square which lies between the two nearest intersecting streets, one on either side of the point at which such building or structure is to be erected, constructed, altered, enlarged or maintained, unless it shall be otherwise specifically provided.

*712. **Frontage Consents—Gas Reservoir—Packing House—Rendering Plant—Soap Factory—Tannery—Blacksmith Shop—Foundry—Machine Shop—Factory, Etc.—Laundry, Etc.—Livery Stable—***Medical Dispensary—Second-hand Store or Yard—Smoke House.)* It shall be unlawful for any person, firm or corporation to locate, build, construct or maintain on any lot fronting on any street or alley in the city in any block in which one-half of the buildings on both sides of the street are used exclusively for residence purposes, or within fifty feet of any such street, any building or place used for a gas reservoir, packing house, rendering plant, soap factory, tannery, blacksmith shop, foundry, machine shop, factory combined with a foundry, laundry to be run by machinery, livery stable, *medical dispensary, or second-hand store or yard, smoke house or place where fish and meats are smoked or cured,* without the written consent of a majority of the property owners according to frontage on both sides of such street or alley. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or alteration of any building or place for any of the above purposes; provided, that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street, and located upon a corner lot shall not be considered.

*Amended May 26, 1913 (medical dispensary, or second hand store or yard).

*Amended July 21, 1913 (smoke house or place where fish and meats are smoked or cured).

712a. **Frontage Consents—For What Required.)** It shall be unlawful for any person, firm or corporation to locate, build or construct any store for the sale at retail of goods, wares and merchandise, on any street in any block in which all the buildings are used exclusively for residence purposes, without first securing and filing with the Commissioner of Buildings the written consent of a majority of the property owners according to frontage on both sides of the street in the block in which the building to be thus used is located; provided, in determining whether all the buildings in the said block are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered.

713. **Reformatories—Sheltering Institutions.)** (a) It shall be unlawful for any person, firm or corporation to build, construct, maintain, conduct or manage any reformatory, rescue or sheltering institution in any block or square in which one-half of the buildings on both sides of the street or streets on which the proposed reformatory, rescue or sheltering institution may front, are used exclusively for residence purposes without the written consent of a majority of the property owners, according to frontage on both sides of the streets bounding such block. Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction, alteration, or maintenance of such building.

(b) Provided, that in determining whether one-half of the buildings on both sides of the street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered.

*714. **Permit for Moving Frame Buildings—Requirements—Written Consents Must Be Obtained—Affidavits Made—Space Occupied on Lot.)** *(a) No person, firm or corporation shall be permitted to move any building which has been damaged to any extent greater than 50% of its value by fire, decay or otherwise; nor shall be permitted to move any frame building of such a character as is prohibited to be constructed within the fire limits from any point outside the fire limits to any point within the fire limits; nor shall be permitted to move any building to a location at which the uses for which such building is designed are prohibited by ordinance. Permits for the moving of frame buildings, other than those the moving of which is herein prohibited, shall be granted upon the securing and filing the written consent of two-thirds of the property owners according to frontage on both sides of the street in the block in which such building is to be moved. No permit shall be issued to move any building used or designed to be used for purposes for which frontage consents are required until frontage consents in the block to which such building is to be moved have also been secured and filed as required by the ordinances relating to such use.*

(b) No building used for residence or tenement house purposes shall be moved from one lot to another or from one location to another upon the same lot unless the space to be occupied on such lot shall comply with the provisions of Section 440 of this chapter

*Amended March 23, 1914.

(c) No frontage consent shall be required of any person, firm or corporation for removing a building upon his own premises and not going upon the premises of any other person, or upon any street, alley or other public place, in making such removal.

715. **Amusements—Frontage Consents Required.)** It shall be unlawful for any person, firm or corporation to construct or erect any building designed or intended to be used for the purpose of presenting or carrying on therein any entertainment for which a license is required by the ordinances of the City of Chicago without first obtaining the written consent of the property owners as required by the City ordinances.

*716. **Garages—Frontage Consents Required.)**

It shall be unlawful for any person, firm or corporation to locate, build, construct or maintain any garage within two hundred feet of any building used as and for a hospital, church or public or parochial school, or the grounds thereof, and it shall be unlawful for any person, firm or corporation to locate, build, construct or maintain any garage in the city in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, or within one hundred feet of any such street in any such block, without securing the written consent of a majority of the property-owners, according to frontage on both sides of the street as provided by the ordinances of the City of Chicago.

Any person violating any of the provisions of this ordinance shall be fined not less than five dollars nor more than one hundred dollars for each offense, and his license shall be subject to revocation by the Mayor.

*Re-passed July 17, 1911, in accordance with court decision, and Sec. 716, Code 1911, repealed.

*717. **Storage of Shavings and Sawdust in Buildings Used for Residence Purposes.)** No person, firm or corporation shall keep, pile, store or accumulate loose shavings, excelsior, sawdust or other similar inflammable materials in any quantity, nor shall any such materials in bales be stored in any quantity exceeding 2,000 pounds in any building used wholly or in part for residence purposes.

*717½. **Frontage Consents—Business of Selling Meats, Etc.)** *It shall be unlawful for any person, firm or corporation to carry on the business of selling meats, poultry, fish, butter, cheese, lard, vegetables or any other provisions from any place of business located in any block in which all the other buildings are used exclusively for residence purposes, without first securing and filing with the City Collector of the City of Chicago the written consent of three-fourths of the property owners according to frontage on both sides of the street in the block in which the building to be thus used is located, provided in determining whether all the buildings in said block are used exclusively for residence purposes, any building fronting on another street and located upon a corner shall not be considered.*

*Amended May 18 and June 9, 1914.

*717¾. No permit shall be issued for the erection or remodeling of any building in any block in which the use of buildings is restricted or regulated by ordinance if such building is designed to be used for conducting therein any business or store, without first requiring the applicant for such permit to file with the Commissioner of Buildings a plat showing the use to which all the property in such block is devoted.

*Amended June 2, 1913, by adding Sec. 717¾.

ARTICLE XXV.
Fire Limits.

*718. **Fire Limits—Provisional Fire Limits.)** (a) The fire limits of the City of Chicago, within which wooden buildings shall not be erected, shall be and they are hereby defined as follows: All that part of the City of Chicago bounded by the following limits: Commencing at the intersection of the shore of Lake Michigan and the center line of Devon avenue, thence west along the center line of Devon avenue to a line one hundred twenty-five feet west of the west line of North Clark street, thence south along said line one hundred twenty-five feet west of the west line of North Clark street to the center line of Lawrence avenue, thence west along the center line of Lawrence avenue to the center line of North Western avenue, thence south along the center line of North Western avenue to the center line of Addison street, thence west along the center line of Addison street to the center line of North Whipple street, thence south along the center line of North Whipple street to the center line of Elston avenue, thence southeast along the center line of Elston avenue to the center line of Roscoe street, thence east along the center line of Roscoe street to the center line of the North Branch of the Chicago River, thence southeasterly along the center line of the North Branch of the Chicago River to the center line of Belmont avenue, thence west along the center line of Belmont avenue to the center line of North Kedzie avenue, thence south along the center line of North Kedzie avenue to the center line of Diversey avenue, thence west along the center line of Diversey avenue to the center line of North Central Park avenue, thence south along the center line of North Central Park avenue to the center line of Fullerton avenue, thence west along the center line of Fullerton avenue to the center line of North 44th avenue, thence south along the center line of North 44th avenue to the center line of West Chicago avenue, thence west along the center line of West Chicago avenue to the center line of North Austin avenue, thence south along the center line of North Austin avenue and South Austin avenue to the north line of the right-of-way of the Baltimore & Ohio Chicago Terminal Railroad Co., thence easterly along the north line of the right-of-way of the Baltimore & Ohio Chicago Terminal Railroad Co. to the center line of South 46th avenue, thence south along the center line of South 46th avenue to the center line of West 22nd street, thence east along the center line of West 22nd street to the center line of South 44th avenue, thence south along the center line of South 44th avenue

to the center line of West 33rd street, thence east along the center line of West 33rd street to the center line of South 40th avenue, thence south along the center line of South 40th avenue to the center line of the Illinois and Michigan Canal, thence northeasterly along the center line of the Illinois and Michigan Canal to the center line of South Western Avenue boulevard, thence south along the center line of South Western Avenue boulevard to the center line of West 39th street, thence east along the center line of West 39th street to the center line of South Robey street, thence south along the center line of South Robey street to the center line of West 43rd street, thence east along the center line of West 43rd street to a line one hundred twenty-five feet west of the west line of South Ashland avenue, thence north along said line one hundred twenty-five feet west of the west line of South Ashland avenue to the center line of West 41st street, thence east along the center line of West 41st street to the center line of South Ashland avenue, thence north along the center line of South Ashland avenue to the center line of West 40th street, thence east along the center line of West 40th street to a line one hundred twenty-five feet east of the east line of South Ashland avenue, thence south along said line one hundred twenty-five feet east of the east line of South Ashland avenue to the center line of West 43rd street, thence west along the center line of West 43rd street to the center line of South Ashland avenue, thence south along the center line of South Ashland avenue to the center line of West 47th street, thence east along the center line of West 47th street to a line one hundred twenty-five feet west of the west line of South Halsted street, thence south along said line one hundred twenty-five feet west of the west line of South Halsted street to the north line of West 51st street, thence east along the north line of West 51st street to a line one hundred twenty-five feet east of the east line of South Halsted street, thence north along said line one hundred twenty-five feet east of the east line of South Halsted street to the center line of West 43rd street, thence east along the center line of West 43rd street to the center line of Wallace street, thence north along the center line of Wallace street to the center line of West 40th street, thence east along the center line of West 40th street to the center line of Butler street, thence south along the center line of Butler street to the center line of West 43rd street, thence east along the center line of West 43rd street to a line one hundred twenty-five feet west of the west line of Wentworth avenue, thence south along said line one hundred twenty-five feet west of the west line of Wentworth avenue to the north line of West Garfield boulevard, then east along the north line of West Garfield boulevard to a line one hundred twenty-five feet east of the east line of Wentworth avenue, thence north along said line one hundred twenty-five feet east of the east line of Wentworth avenue to the center line of West 43rd street, thence east along the center line of West 43rd street to a line one hundred twenty-five feet west of the west line of South State street, thence south along said line one hundred twenty-five feet west of the west line of South State street to the center line of West Garfield boulevard, thence west along the center line of West Garfield boulevard to the center line of Union avenue, thence north along the center line of Union avenue to the center line of West 51st street, thence west along the center line of West 51st street to the center line of South Centre avenue, thence south along the center line of South Centre avenue to a line one hundred twenty-five feet north of the north line of West 63rd street, thence west along said line one hundred twenty-five feet north of the north line of West 63rd street to the center line of South Ashland avenue, thence south along the center line of South Ashland avenue to a line one hundred twenty-five feet south of the south line of West 63rd street, thence east along said line one hundred twenty-five feet south of the south line of West 63rd street to the center line of South Centre avenue, thence south along the center line of South Centre avenue to the center line of West 75th street, thence east along the center line of West 75th street to the center line of South State street, thence south along the center line of South State street to the center line of East 79th street, thence east along the center line of East 79th street to the center line of Cottage Grove Avenue, thence north along the center line of Cottage Grove avenue to the center line of East 75th street, thence east along the center line of East 75th street to the center line of South Shore avenue, thence southeasterly along the center line of South Shore avenue to the center line of East 79th street, thence east along the center line of East 79th street to the center line of Ontario avenue, thence south along the center line of Ontario avenue to the center line of East 83rd street, thence east along the center line of East 83rd street to the center line of Superior avenue, thence south along the center line of Superior avenue to the center line of East 89th street, thence west along the center line of East 89th street to the center line of Manistee avenue, thence south along the center line of Manistee avenue (and Manistee avenue produced) to the northeasterly line of the right-of-way of the Lake Shore and Michigan Southern Railroad Co., thence southeasterly along the northeasterly line of the right-of-way of the Lake Shore and Michigan Southern Railroad Co., to the center line of East 95th street, thence west along the center line of East 95th street, to the South Chicago branch of the Pittsburgh, Fort Wayne & Chicago Railroad Co., thence southeasterly and southwesterly along the South Chicago branch of the Pittsburgh, Fort Wayne & Chicago Railroad to the center line of East 106th street, thence east along the center line of East 106th street to a line two hundred feet east of the east bank of the Calumet River, thence northerly along said line two hundred feet east of the east bank of the Calumet River to the center line of East 95th street, thence east along the center line of East 95th street to Lake Michigan, thence northerly and northwesterly along the shore of Lake Michigan to the place of beginning.

(b) Also, commencing at the intersection of the shore of Lake Calumet and the center line of Stony Island avenue, thence north along the center line of Stony Island avenue to the center line of East 95th street, thence west along the center line of East 95th street to the center line of South Park avenue, thence south along the center line of South Park avenue and South Park avenue produced to the center line of East 103rd street, thence east along the center line of East 103rd street to the center line of Corliss avenue, thence south along the center line of Corliss avenue to the center line of East 106th street, thence west along the center line of East 106th street to the center line of Cottage Grove avenue, thence southwesterly along the center line of Cottage Grove avenue to the center line of East 109th street, then west along the center line of East 109th street to the center line of South Park avenue produced, thence south along the center line of South Park avenue produced to the center line of East 115th street, thence east along the center line of East 115th street to the northeasterly line of the right-of-way of the Michigan Central Railroad Co., thence southeasterly along the northeasterly line of the right-of-way of the Michigan Central Railroad Co. to the center line of East 127th street, thence east along the center line of East 127th street to the shore of Lake Calumet, thence northerly along the shore of Lake Calumet to Stony Island avenue, the place of beginning.

*Par. (b) amended October 15, 1913.

(c) Excepting the district bounded as follows: Commencing at the intersection of the center line of Belmont avenue and the center line of the North branch of the Chicago River, thence east along the center line of Belmont avenue to the center line of Southport avenue, thence south along the center line of Southport avenue to the center line of Fullerton avenue, thence west along the center line of Fullerton avenue to the center line of the North branch of the Chicago River, thence northwesterly along the center line of the North branch of the Chicago River to the center line of Belmont avenue, the place of beginning.

(d) Excepting, also, so much of the land from which clay has been removed and in which filling has been placed in the district bounded as follows: Commencing at the intersection of the center line of Addison street and the center line of North Western avenue, thence south along the center line of North Western avenue to the center line of Belmont avenue, thence west along the center line of Belmont avenue to the center line of the North Branch of the Chicago River, thence northerly along the center line of the North branch of the Chicago River to the center line of Addison street, thence east along the center line of Addison street to the center line of North Western avenue, the place of beginning.

*(dd) Excepting, also, for the period extending from the time of the passage of this ordinance up to the first day of January, 1915, that territory bounded by a line commencing at a point in the center of South Peoria street where it intersects the center of West 52nd street, thence west along the center line of West 52nd street to the center line of South Morgan street, thence south along the center line of South Morgan street to the center line of West 53rd street, thence east along the center line of West 53rd street to the center line of South Peoria street, thence north along the center line of South Peoria street to the place of beginning, this exception, however, not to extend beyond the said first day of January, 1915, after which date Paragraph (dd) of this ordinance shall no longer be in force.

*Amended by (adding paragraph (dd)) July 30, 1913.

(e) Excepting, also, the following territory, which shall be known as a provisional fire limit: Commencing at the intersection of the shore of Lake Michigan and the center line of East 79th street, thence west along the center line of East 79th street to the center line of South Shore avenue, thence northwesterly along the center line of South Shore avenue to the center line of East 75th street, thence west along the center line of East 75th street to the center line of South State street, thence north along the center line of South State street to the northwesterly line of the right-of-way of the Lake Shore & Michigan Southern Railroad Co., thence southeasterly along the northwesterly line of the right-of-way of the Lake Shore & Michigan Southern Railroad Co. to the center line of East 67th street, thence east along the center line of East 67th street to the center line of South Park avenue, thenee north along the center line of South Park avenue to the center line of East 63rd street, thence east along the center line of East 63rd street to the center line of Cottage Grove avenue, thence south along the center line of Cottage Grove avenue to the center line of East 67th street, thence east along the center line of East 67th street to the shore of Lake Michigan, thence southerly and southeasterly along the shore of Lake Michigan to the place of beginning.

(f) The following district outside of the above described fire limits is hereby established as a provisional fire limit district: Commencing at the intersection of the center line of Stony Island avenue and the center line of East 75th street, thence south along the center line of Stony Island avenue to the center line of East 79th street, thence east along the center line of East 79th street to the center line of Jeffrey avenue, thence north along the center line of Jeffrey avenue to the center line of East 75th street, thence west along the center line of East 75th street to the center line of Stony Island avenue, the place of beginning.

(g) Any person desiring to erect a frame or wooden building to be used for residence or mercantile purposes within the provisional fire limits above described shall have a right to do so, upon presenting a petition to the Commissioner of Buildings together with a plat, plans and specifications showing the place where such building is to be erected. Such petition shall be verified by the affidavit of the applicant and shall contain the written consent of the owners of a majority of the frontage upon both sides of the streets surrounding the square in which the building is to be erected.

(h) No frame or wooden residence or mercantile building shall be erected within the said provisional fire limits exceeding forty feet high.

*Amended November 25, 1912 (new ordinance)

719. **Nuisance.)** (a) Every building or structure constructed or maintained in violation of this chapter, or which is in an unsanitary condition, or in an unsafe or dangerous condition or which in any manner endangers the health or safety of any person or persons, is hereby declared to be a public nuisance.

(b) Every building or part thereof which is in an unsanitary condition by reason of the basement or cellar being damp or wet, or by reason of the floor of such basement or cellar being covered with stagnant water, or by reason of the presence of sewer gas, or by reason of any portion of a building being infected with disease or being unfit for human habitation or which by reason of any other unsanitary condition, is a source of sickness, or which endangers the public health, is hereby declared to be a public nuisance.

720. **Penalty.)** Any person, or corporation who violates, neglects or refuses to comply with, or who resists or opposes the enforcement of any of the provisions of this chapter, shall be fined not less than twenty-five nor more than two hundred dollars for each offense, and every such person or corporation shall be deemed guilty of a separate offense for every day on which such violation, neglect or refusal shall continue; and any builder or contractor who shall construct any building in violation of any of the provisions of this chapter, and any architect designed, drawing plans for or having charge of such building or who shall permit it to be constructed, shall be liable to the penalties provided and imposed by this section.

721. **No Amusement License to Issue Without Certificate from City Officials.)** No license shall be issued to any person, firm or corporation to produce, present, conduct, operate or offer for gain or profit, any theatricals, shows or amusements until the Commissioner of Buildings, the Commissioner of Health, the Fire Marshal and the City Electrician shall have certified in writing that the room or place where it is proposed to produce, present, conduct, operate or offer such theatricals, shows or amusements complies in every respect with the ordinances of the City of Chicago.

722. **Lighting — Buildings Kept Lighted During Performance.)** Every portion of any building or structure in which theatricals, shows and amusements are offered, operated, presented or exhibited for

gain or profit devoted to the use or accommodation of the public, and all outlets therefrom leading to the street, including all open courts, corridors, stairways, exits and emergency exit stairways shall be well and properly lighted during every performance, and shall remain lighted until the entire audience has left the premises. It shall be the duty of the Fire Marshal to enforce the provisions of this section.

723. **Independent Lighting Systems for Exits.)** All stairways and corridors in every building or structure in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain, shall be supplied with a supplemental lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building or structure and shall be in operation during the entire period that such building or structure is open to the public and until the entire audience has left the building.

The word "Exit" shall appear in letters at least six inches high over the opening of every means of egress from such building or structure, and a red light shall be kept burning over such sign.

It shall be the duty of the City Electrician to enforce the provisions of this section relative to the installation of the lighting provisions contained therein; and it shall be the duty of the Fire Marshal to see the lights are kept lighted as required by this section.

724. **Gas Calcium Lights Prohibited—Arc Lights.)** The use of gas calcium lights in any building in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain, is hereby prohibited.

All arc lights used on the stage shall be subject to the approval of the City Electrician.

725. **Exit Doors or Gates Not to be Locked—Obstructions Prohibited.)** No exit door or gate in any place in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain, shall be locked or fastened in any manner during the entire time that such place of amusement is open to the public.

All aisles, passageways, corridors and exits of all such places of amusement shall be kept free from camp stools, chairs, sofas, draperies and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles, passageways, corridors or exits during any performance.

726. **Diagram of Exits and Seats.)** It shall be the duty of the owner, lessee or manager of any theater having a seating capacity in excess of 300 persons, to cause to be printed on all programs furnished for any performance, on the page opposite to that upon which the cast is printed, a diagram showing conspicuously the place of every exit from such building. A diagram of the floor plan showing the location of every seat on each floor, and also the exits leading from each floor, drawn to a scale of one-eighth of an inch to the foot, shall be posted in a conspicuous place in the box office of any such theater, so as to be easily seen by the public. It shall be the duty of the Fire Marshal to enforce the provisions of this section.

727. Any person, firm or corporation violating any of the provisions of this ordinance shall be fined not more than two hundred dollars for each offense, and each and every day upon which any such person, firm or corporation shall give, conduct, produce, present, offer or operate any such entertainment contrary to or in violation of any of the provisions of this ordinance shall constitute a separate and distinct offense.

Section 8. This ordinance shall be in full force and effect from and after its passage, approval and due publication.

Passed Dec. 5th, 1910.

AN ORDINANCE

Concerning special stage firemen and fire guards in theatres having a seating capacity for three hundred or more persons.

[Inserted as Sections 931 to 939, inclusive, in The Chicago Code of 1911.]

Be it ordained by the City Council of the City of Chicago:

Section 1. **Special Stage Firemen and Fireguards Required.)** It shall be the duty of every person, firm or corporation conducting, operating or maintaining any room in a building which is used regularly for theatrical or vaudeville purposes and where an admission fee is charged and having a seating capacity for three hundred or more persons, to procure and keep at his, their or its own expense one adult male person as a special stage fireman and one adult male person as a fireguard who shall wear such uniform and badge as the Fire Marshal of the City of Chicago may prescribe. Such special stage fireman shall be responsible to and under the direction and subject to the control of said Fire Marshal or his accredited representative during such time as any such theatre may be open to the public. Such special stage fireman shall be kept on duty by every such person, firm or corporation at every such building conducted by him, them or it as aforesaid at least thirty minutes prior to the commencement of any performance, during the entire time of such performance and until the entire audience shall have left the building.

Section 2. **Duties of Special Stage Fireman.)** It shall be the duty of such special stage fireman to see that all fire appliances on the stage and above and below, it, in the dressing rooms and throughout the basement of any such building used as a theatre, are in their proper places and in good working order; that the tanks supplying the standpipes and the sprinkling system are full of water, that the ventilator above the stage and other ventilation apparatus used in connection with the theatre are in operation and in good working order and changing the air, as required by the ordinances of the city. Such special stage fireman shall make daily reports, in duplicate, in such manner and form as said Fire Marshal shall prescribe, which report shall be countersigned by the fireguard. The original of the aforesaid report shall be delivered to the Fire Marshal of the City of Chicago and the duplicate thereof shall be delivered to the owner of the theatre, where such special stage fireman is employed, or to the person having the management thereof. Said special stage fireman shall be subject to the orders of the Fire Marshal during such time as the theatre shall be open and occupied by the public.

Section 3. **Fireguard—Duties.)** It shall be the duty of such fireguard to see that all exit doors are unfastened and unobstructed, that the aisles are kept clear and free from all obstructions and that all the provisons of the ordinances of the City of Chicago relating to theatres are observed and complied with. Such fireguard may, in the discretion of the owner or manager of the theatre wherein he is employed, act as chief usher or auditorium superintendent during performances.

Section 4. **Monthly Report to Fire Marshal.)** It shall be the duty of such special stage fireman and fireguard to report in person to the Fire Marshal or his accredited representative, at least once in each

month, and they and each of them shall be subject to, and required to obey such rules and regulations as the Fire Marshal shall prescribe governing the duties to be performed by them in conformity with this ordinance; provided, however, that such rules and regulations shall apply to all special stage firemen and fireguards.

Section 5. **Interpretation.)** This ordinance shall not be so construed as to prevent the owners or managers of theatres employing special stage firemen or fireguards from assigning such persons so employed to duties other than those enumerated in this ordinance when the theatre is not open to the public.

Section 6. **Duties of Fire Marshal—License—Revocation.)** Said Fire Marshal shall cause all such theatres to be inspected daily by a proper officer of the Fire Department, and he shall also examine all persons who desire to seek employment as special stage firemen or fireguards, as to their qualifications and fitness for the duties for which they seek to be employed, and whenever said Fire Marshal finds any such applicant to be competent, he shall, without charge, issue a license to such applicant and he may revoke any such license issued by him at any time, when in his judgment such special stage fireman or fireguard is incompetent, inefficient or has neglected to perform the duties required of him in this ordinance; provided, however, that said Fire Marshal shall not revoke any license without giving to the person to whom such license was issued a reasonable opportunity to be heard on the subject of such revocation.

It shall be unlawful for any person, firm or corporation to employ a person either as special stage fireman or as a fireguard unless such person is licensed as provided in this ordinance.

Section 7. **Fire Apparatus.)** In every building or place having a seating capacity of less than 300, in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain, there shall be provided and kept upon the stage, two hand water pumps, two fire axes, two pike poles, and also one hand water pump in the basement or other portion of the building or place used as a dressing room or rooms; also one hand water pump and one fire axe in the auditorium thereof.

In every building or place having a seating capacity in excess of three hundred persons in which theatricals, shows and amusements are offered, operated, presented or exhibited for gain, there shall be kept two or more portable fire extinguishers on the stage and two or more portable fire extinguishers under the stage, which shall at all times be kept filled with water; also four fire axes, two 15-foot pike poles and two 10-foot pike poles on each tier or floor of the stage.

Section 8. **Fire Apparatus to be Under Control of Fire Department.)** All standpipes, automatic sprinklers, gas pipes, electric wires, hose, footlights, fire alarm boxes, fireproof proscenium curtains, switch boxes, ventilators, controlling levers, axes, pike poles and all apparatus for the extinguishing of fire or guarding against fire shall be kept at all times in a condition satisfactory to and under the control of the Fire Marshal.

Section 9. **Penalty).** Any person, firm or corporation who violates, neglects or refuses to comply with the provisions of this ordinance shall be fined not less than twenty-five ($25.00) dollars nor more than two hundred ($200.00) dollars for each offense, and every such person, firm or corporation shall be deemed guilty of a separate offense for every day that such violation, neglect or refusal shall continue and any proprietor of a theatre who shall have violated any of the provisions of the foregoing sections, shall in the discretion of the Mayor on recommendation by said Fire Marshal, have his, their or its license to conduct, operate or maintain such theatre revoked.

Section 10. This ordinance shall be in full force and effect from and after its passage, approval and due publication.

Passed Dec. 5th, 1910.

STABLING HORSES.

(A health-measure provision passed December 12, 1910.)

AN ORDINANCE.

Prohibiting the construction or maintenance of any building for stabling ten or more horses within one hundred feet of any school, church, hospital, public park or public playground.

Be it ordained by the City Council of the City of Chicago:

Section 1. That it shall hereafter be unlawful for any person, firm or corporation to locate, build, construct or maintain any building or structure for stabling or keeping of ten or more horses within a distance of one hundred (100) feet from any school, church, hospital, public park or public playground.

Section 1 is included in Code 1911 as paragraph c, Section 616.

Section 2. Any person, firm or corporation violating any of the provisions of the foregoing section shall be fined not less than twenty-five dollars ($25.00) nor more than two hundred dollars ($200.00) for each offense.

Section 3. This ordinance shall be in full force and effect from and after its passage, approval and due publication.

ORDINANCE CONCERNING GARAGES.

Be it ordained by the City Council of the City of Chicago:

Section 1. No person, firm or corporation shall keep, conduct or operate a garage in this city without first obtaining a license so to do in the manner hereinafter provided, and it shall not be lawful for any person, firm or corporation to locate, build, construct or maintain any garage within two hundred feet of any building used as and for a hospital, church, or public or parochial school or the grounds thereof, nor shall any person, firm or corporation locate, build, construct or maintain any garage in the city in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes or within one hundred feet of any such street in any such block, without the written consent of a majority of the property owners according to frontage on both sides of the street.

Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction of any such building; provided, that in determining whether two-thirds of the buildings on both sides of such street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered; and provided, further, that the word "block," as used in this section, shall not be held to mean a square but shall be held to embrace only that part of the street

in question which lies between the two nearest intersecting streets, one on either side of the lot on which said garage is to be located, built, constructed or maintained.

Section 2. Any person desiring to keep, conduct or operate a garage shall make application to the Mayor on a form to be provided by the City Collector. Such application shall set forth the name of the applicant, and, if an individual or individuals, the place of his or their residence, and, if a corporation, the names of the officers and their places of residence. Such application shall also contain the location of the place at which it is intended to keep such garage and the number of vehicles to be kept in such garage for the purpose of letting for hire or reward, together with a description of the style or type thereof. The Mayor shall thereupon issue or cause to be issued a license upon the payment by such applicant to the City Collector of a license fee in accordance with the rates hereinafter fixed.

Section 3. For all garages where vehicles are kept ready for use and where rent is paid to the keeper thereof for such keeping, or where vehicles are kept to be let out for hire or reward, or where vehicles are kept ready for use and where rent is paid to the keeper thereof and where vehicles are kept to be let out for hire or reward, the license fee shall be twenty-five dollars per annum.

Section 4. All such licenses shall expire on the thirty-first day of December following the date of issue, and, when issued for a period of more than six months, the license fee shall be the full annual license fee prescribed in the foregoing section. When issued for a period of less than six months, the license fee shall be one-half of the annual fee prescribed in the foregoing section.

If such garage keeper shall at any time, before the expiration of any license issued to him under the provisions of this article, change his place of business, he shall forthwith give notice of such fact to the City Collector.

Section 5. Any person violating any of the provisions of this ordinance, shall be fined not less than five dollars nor more than one hundred dollars for each offense, and his license shall be subject to revocation by the Mayor.

Section 6. That Sections 2684 and 2685 of The Chicago Code of 1911, adopted March 13, 1911, and all ordinances and parts of ordinances conflicting with this ordinance be and the same are hereby repealed.

Section 7. This ordinance shall take effect from and after its passage and due publication.

Passed July 17, 1911.

AN ORDINANCE

Requiring that every portion of a moving picture theatre shall be lighted during exhibitions.

Be it ordained by the City Council of the City of Chicago:

Section 1. Every portion of a moving picture theatre, including exits, courts and corridors, devoted to the use or accommodation of the public, shall be so lighted by electric light during all exhibitions and until the entire audience has left the premises that a person with normal eyesight shall be able to read Snellen Standard Test Type 40 at a distance of twenty feet and Type 30 at a distance of 10 feet; normal eyesight meaning ability to read Type 20 at a distance of 20 feet in daylight. Cards showing Types 20, 30 and 40 should be displayed in the corridor of every such theatre together with a copy of this ordinance.

Section 2. Any person, firm or corporation who violates, neglects or refuses to comply with, or who resists or opposes the enforcement of this ordinance shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense, and every such person, firm or corporation shall be deemed guilty of a separate offense for every day on which such violation, neglect or refusal shall continue.

Section 3. This ordinance shall be in full force and effect from and after the first day of January, 1913.

Passed July 22, 1912.

AN ORDINANCE

Declaring theatres located above the first floor of buildings nuisances.

Be it ordained by the City Council of the City of Chicago:

Section 1. That it shall be and it is hereby declared to be a nuisance to conduct a public theatre in a room located on any floor above the first floor level of a building of other than fireproof construction or a building which did not comply with the ordinances of the City of Chicago with reference to fireproof construction in force at the time such building was built, and that all such public theatres now being conducted in rooms on any floor above the first floor level of a building of other than fireproof construction or a building which did not comply with the ordinances of the City of Chicago with reference to fireproof construction in force at the time such building was built, with a seating capacity of more than three hundred, shall be and they are hereby declared to be nuisances; and it shall be unlawful to continue to use such rooms for public theatrical purposes whether the same are equipped with a stage and scenery or are used for moving picture shows only.

The provisions of the foregoing paragraph shall not apply where the theatre is altered so as to bring the main audience room on the first floor level and slow-burning construction is used in the reconstruction work and in making such alterations and all requirements of the ordinances of the City applying to Class IVb are complied with, nor shall said provisions apply where the following conditions are fully complied with:

(a) The building shall be used for theatre purposes only.

(b) The seating capacity shall not exceed the seating capacity at the time of passage of this ordinance.

(c) Metal scenery only shall be used; provided, however, one proscenium drop, one back drop and three borders may be used provided they are of asbestos cloth subject to the approval of the Fire Marshal.

(d) All seats shall be at least eighteen inches wide and spaced thirty-two inches from back to back.

(e) There shall be no boxes, stalls or loges.

(f) No stove or furnace heating shall be allowed.

(g) All lighting shall be by electricity; provided, however, that gas may be used in connection with exit lights.

(h) At least sixty inches of exit space shall be provided for every one hundred seats.

(i) The stage shall not be more than twenty-two feet from front to rear.

(j) The audience room shall be surrounded by brick walls.

(k) In all cases where dressing rooms are placed back of the stage the brick wall shall extend between the stage and such dressing rooms, but the stage wall may contain a door leading to such dressing room located behind said wall.

(l) All dressing rooms shall have incombustible partitions and all existing wooden partitions, wherever located, shall be removed.

(m) There shall be an open space on at least three sides of the building containing such theatre, except as otherwise herein provided, which space shall be open from the floor level of the auditorium to the sky.

(n) One of such open spaces must be a public street and the others public or private alleys or open spaces leading directly to a street or public or private alley, and in all cases where such open space is private ground, it must be at least five feet wide where the seating capacity does not exceed six hundred, and six inches additional width must be provided for each one hundred seats installed in such theatre in excess of six hundred; provided, however, that in all cases where a sprinkler system is installed over the stage, together with an approved power pump and pressure tank subject to the approval of the Fire Marshal, it shall be sufficient if there are open spaces as above required on two sides of the building in which such theatre is located.

(o) Wherever the side of an audience room adjoins an open space, as hereinabove required, which open space is on private ground or is a private or public alley, there shall be a five-foot open iron platform extending the entire length of the audience room, with an open iron stairway leading to the ground from said platform at each end thereof, and in all such cases there shall be a stairway fire escape leading from the gallery of the theatre, if there is a gallery, to such platform.

(p) Where the only open space adjoining the side of the audience room is a public street, there shall be a five-foot stairway, enclosed by walls of incombustible material, leading from the middle of the audience room on the side contiguous to such street to the first floor, at the bottom of which stairway there shall be an exit opening directly to the street, and in such cases there shall be a three-foot stairway leading from the gallery, if there is a gallery, to the main floor of the auditorium, the bottom of which shall be within ten feet of the stairway leading from such main floor to the ground floor.

(q) There shall be an exit at least five feet wide on each side of the stage, which exit shall lead through a passageway constructed entirely of incombustible material to a stairway which shall be completely enclosed with incombustible material. Said stairway shall lead to the ground level and communicate through a passageway of incombustible material directly with a public street or alley or a private alley which leads directly to a public street or alley.

(r) An exit shall be provided on each side of the balcony or gallery at the end nearest the stage by means of a stairway of incombustible material leading to the main floor of the audience room.

(s) The exits at the front of the theatre shall communicate with stairways of incombustible material leading directly to the ground level and either opening directly out upon the street or communicating with the street through fireproof passageways, and in no case shall any stairway leading from the main audience floor to the ground level communicate or connect with any other such stairway.

(t) All doors leading through the proscenium wall or from the stage to the dressing rooms shall be of incombustible material.

(u) All alterations made in buildings containing such theatres shall be of slow-burning construction, except as herein otherwise provided.

Section 2. Any person, firm or corporation that shall violate any of the provisions of this ordinance shall be fined not less than twenty-five ($25.00) dollars nor more than two hundred ($200.00) dollars for each offense, and each day's operation contrary to this ordinance shall be considered a distinct and separate offense.

Section 3. This ordinance shall take effect and be in force from and after its passage and due publication.

Passed July 22, 1912.

ORDINANCE LIMITING LOCATION OF HOSPITALS.

Be it ordained by the City Council of the City of Chicago:

SECTION 1. That Section 1220 of The Chicago Code of 1911 be and the same is hereby amended so as to read as follows:

"1220. (*Location of Hospital near School or Playground.*) No hospital of any kind or description shall hereafter be erected or established within four hundred feet of any property used for public or parochial school purposes *or as a public playground.*"

SECTION 2. This ordinance shall take effect and be in force on and after its passage and due publication.

Passed April 29, 1912.

AN ORDINANCE.

Amending Article II of Chapter LXXI of The Chicago Code of 1911.

Be it ordained by the City Council of the City of Chicago:

Section 1. That Article II of Chapter LXXI of The Chicago Code of 1911, be and the same is hereby amended by inserting therein a new section to be known as "2414½", after Section 2414 and before Section 2415, as follows:

"2414½. **Location of Ice Making Houses and Cooling Plants.)** It shall be unlawful for any person, firm or corporation to locate, establish, conduct or maintain any

ice making house or cooling plant within four hundred (400) feet of any church, hospital, public or parochial school, said distance to be measured by the shortest straight line between the ice making house or cooling plant sought to be so located, established, conducted or maintained, and any such building used for the purpose of a church, hospital, public or parochial school."

Section 2. This ordinance shall take effect and be in force from and after its passage and due publication.

Ordinance passed December 30, 1912.

Be it ordained by the City Council of the City of Chicago:

Section 1. It shall be unlawful for any person, firm or corporation to locate, establish, conduct or maintain any ice making house or cooling plant in any block in which two-thirds of the buildings fronting on both sides of the street on which the proposed plant shall be located are devoted exclusively to residence purposes unless the owners of the majority of the frontage in said block on both sides of the street on which said plant is located shall consent in writing to the location, establishment, conducting or maintenance of such plant in such block, such written consents of the majority of Said property owners shall be filed with the Commissioner of Buildings before a permit shall be granted for the building or constructing of any such ice making house or cooling plant.

Section 2. Any person, firm or corporation violating any of the provisions of this article, or refusing, failing or neglecting to comply with any of the said provisions, shall be fined not less than $5.00 nor more than $100.00 for each offense, and a separate offense shall be regarded as having been committed for each day during which such violation shall continue.

Section 3. This ordinance shall take effect and be in force from and after its passage and due publication.

Ordinance passed January 8, 1913.

Be it ordained by the City Council of the City of Chicago:

Section 1. That The Chicago Code of 1911 be and the same is hereby amended by inserting after Section 2444 thereof three (3) sections numbered respectively 2444a, 2444b and 2444c, to read as follows:

2444a. **Erection of Building or Other Structure in Street Forbidden.)** No person or corporation shall erect or place any building or other structure, in whole or in part, upon any street, alley, sidewalk or other public ground within the city, and every person or corporation that violates or fails to comply with any of the provisions of this section shall be fined not less than twenty-five dollars nor more than two hundred dollars.

2444b. **Obstruction Upon Streets—New Street.)** The owner of any building, structure, fence, porch, steps, gallery or other obstruction now standing or which may hereafter be erected or placed upon any street, alley, sidewalk or public ground within this city, or which may be left standing upon any new street that has been opened, or may hereafter be opened, shall remove the same within such reasonable time, not exceeding thirty days, as may be fixed by the Commissioner of Public Works in a written notice to be served as hereinafter provided for, but the time fixed therein shall not be less than five days after such service. Such written notice may be served upon the owner or upon the person or corporation in possession or occupancy of the premises, or by posting the written notice upon such building, structure, fence, porch, steps, gallery or other obstruction.

Any person or corporation violating any of the provisions of this section shall be fined not less than twenty-five dollars nor more than two hundred dollars, and shall be fined a further sum of ten dollars for each and every day such building, structure, fence, porch, steps, gallery or other obstruction shall remain after the expiration of the time fixed for the removal of same in the written notice given as in this section provided.

2444c. **Refusal to Remove—Nuisance.)** Whenever the owner of any building, structure, fence, porch, steps, gallery or other obstruction upon any street, alley, sidewalk or public ground in this city, shall refuse or neglect to remove the same, after notice served as prescribed in the preceding section, the same shall be deemed a nuisance, and the Commissioner of Public Works shall cause the same to be removed or taken down, and the expense of such removal or taking down shall be recoverable from the owner in an action of assumpsit, and every person who shall forcibly and unlawfully resist the execution of any order of the Commissioner of Public Works in the premises shall be deemed guilty of disorderly conduct and shall be subject to a penalty of not less than five dollars nor more than two hundred dollars.

Section 2. That an ordinance amending The Chicago Code of 1911 by inserting after Section 2444 three sections numbered 2444a, 2444b and 2444c, passed by the City Council of the City of Chicago on March 9, 1914, and appearing on pages 4355 and 4356 of the Journal of the Proceedings of the City Council of that date be and the same is hereby repealed.

Section 3. This ordinance shall take effect and be in force from and after its passage, approval and publication.

Ordinance passed April 27, 1914.

AN ORDINANCE

Requiring the Installation of Gas Shut-offs.

Be it ordained by the City Council of the City of Chicago:

Section 1. All persons, firms or corporations furnishing or supplying gas for lighting, heating or other purposes through pipes or mains laid in the streets or alleys in the City of Chicago, shall equip with a gas shut-off, at their own expense, every service pipe or lead of three-fourths-inch or larger diameter owned or controlled by them through which gas is furnished or supplied from their mains laid in such streets or alleys to buildings or structures other than those used or intended to be used exclusively for residence purposes and occupied by less than four families. Every gas shut-off shall be so constructed as to operate manually to shut off the flow of gas so that in case of fire or other dangerous conditions, it shall not be necessary for firemen or other persons to enter the building or structure supplied with gas to do so, and every such gas shut-off shall be so constructed as to permit of manual control from above the ground and outside of the building or structure to which gas is supplied by such service pipe or lead. Such gas shut-offs may be located in the streets or alleys, but when so located shall be constructed so as not to interfere with public travel at such places as may be designated by the fire marshal of the City of Chicago.

Section 2. That all gas shut-offs required to be installed by this ordinance shall be approved by and installed under the supervision and control of the fire marshal of the City of Chicago, and shall at all times be subject to his supervision and control.

Section 3. Any person, firm or corporation failing to equip any service pipe or lead owned or controlled by him or it with a gas shut-off, as required by this ordinance, on or before July 1, 1915, shall be subject to a fine of not less than five ($5) dollars nor more than fifty ($50) dollars for each offense, and such offense shall be considered to exist for failure to comply herewith on each and every day such failure continues.

Section 4. Any person who, without the consent of the owner, shall destroy, meddle or tamper with any gas shut-off or any part thereof, or attachment thereto, which has been approved and installed in compliance with this ordinance, shall be subject to a fine of not less than fifty ($50) dollars nor more than two hundred ($200) dollars for each offense.

Section 5. This ordinance shall take effect and be in force from and after its passage, approval and due publication.

Ordinance passed July 2, 1914.

AN ORDINANCE

To provide for the licensing and regulation of mason contractors and employing masons.

Be it ordained by the City Council of the City of Chicago:

Section 1. Any person, firm or corporation engaged in or desiring to engage in or work at the business of masonry or mason work, either as contractor, sub-contractor or employing mason, in the City of Chicago, shall submit to an examination and shall obtain a license as a mason contractor or employing mason in the manner hereinafter provided for; provided, that whenever a firm or corporation consists of more than one master or employing mason, it shall not be necessary for more than one member of said firm or one officer of said corporation to undergo such examination in order to obtain a license for such firm or corporation. The words "masonry" or "mason work" as herein used shall include all work in brick, stone, concrete, terracotta, tile and fireproofing, or any combination of these materials, as used in and about the construction of buildings or structures above or below the surface of the ground, with the exception of laying brick or concrete sidewalks and brick or concrete paving.

Section 2. There is hereby created a board of examiners of mason contractors, consisting of three members, one of whom shall be the Commissioner of Buildings, who shall be ex officio chairman of said board of examiners, a second member who shall be a practical architect, and a third member, who shall be a practical mason. Said second and third members shall be appointed by the Mayor, by and with the advice and consent of the City Council, and their term of office shall extend until the first day of May following their appointment, and their successors shall be appointed in like manner for the term of one year annually before the first day of May. Each of said second and third members so appointed shall, before entering upon the duties of his office, execute a bond to the city in the sum of Five Thousand Dollars ($5,000), with sureties to be approved by the City Council, conditioned for the faithful performance of the duties of the office to which he has been appointed. Each of the members of the said board of examiners of mason contractors shall receive such salary as may be provided therefor in the annual appropriation bill.

Section 3. The secretary to the Board of Examiners of Plumbers shall act as secretary to the said board of examiners of mason contractors. It shall be his duty to preserve and keep all of the records, books and papers, which are required by law to be kept by or filed with the said board of examiners of mason contractors, and to do and perform such other service as may be from time to time required of him by said board.

Section 4. Any person, firm or corporation desiring to procure a license as a mason contractor or employing mason shall make application to the board of examiners of mason contractors and shall, at such time and place as said board may designate, undergo such examination as to qualifications and competency to engage in such business as the said board of examiners may direct. Said examination shall be made in whole or in part in writing and shall be of a practical and elementary character, sufficiently strict, to test the qualifications of the applicant. Where the applicant is a firm or corporation such applicant shall state in writing the name or names of the person or persons connected therewith who will submit to such examination as to qualifications, and in case such firm or corporation receives a license and thereafter severs its connection with such person or persons, so that no member of said firm or office of said corporation has qualified as a mason contractor or employing mason as required by this ordinance, the license granted to such firm or corporation shall no longer be in force, and such firm or corporation shall be required to make a new application for a license in the same manner as before.

Section 5. Said board of examiners of mason contractors shall examine such applicants as to their practical knowledge of masonry and mason construction and all matters pertaining to mason construction and, if satisfied of the competency of any such applicant, shall thereupon issue a license to such applicant, authorizing him to engage in the business of mason contracting or employing mason. The fee for such examination, including the first year's license fee, shall be fifty dollars, and thereafter the annual license fee for such mason contractor or employing mason shall be twenty-five dollars; said license shall be valid and have force for a period of one year from the date of issuance, except as herein otherwise provided, and may be renewed upon its expiration by paying in advance the annual renewal fee. All fees received for said examinations and licenses shall be paid into the city treasury.

Section 6. All mason work placed in or upon or in connection with any building or other structure in the City of Chicago shall be done in accordance with the ordinances regulating materials, construction, alteration and inspection of such work now or hereafter in force in the City of Chicago, and no mason work shall be done upon any building without a permit being first issued therefor by the Commissioner of Buildings. In every case where any mason work forms a part of the work to be done in or about the construction of a building or other structure for which a building permit is required under the ordinances of the city, such permit shall only be issued upon the application of a person, firm or corporation licensed as a mason contractor or employing mason, or upon an application containing a statement that all mason work on such building or other structure will be performed by a licensed mason contractor or employing mason; and in case any masonry or mason work on any such building or other structure shall be performed by any contractor or employing mason not licensed as herein provided, such permit shall be revoked, and the person or persons performing such work and the person or persons having such work done shall be subject to the penalty herein prescribed.

Section 7. Any person, firm or corporation engaged in the business of contracting for masonry or mason work that shall fail to procure a license as herein provided for, or any person, firm or corporation that shall

violate any of the provisions of this ordinance, shall be fined not less than five dollars nor more than fifty dollars for each offense, and in addition to such penalty the license of any person, firm or corporation licensed hereunder may be revoked for cause in the discretion of the Mayor.

Section 8. This ordinance shall take effect and be in force from and after its passage and due publication.

Ordinance passed January 16, 1914.

Be it ordained by the City Council of the City of Chicago:

Section 1. That Section 309 of an ordinance entitled "An ordinance creating the bureau of fire prevention and public safety," passed by the City Council of the City of Chicago, July 22nd 1912, and subsequently amended, be and the same is hereby further amended so as to read as follows:

"Section 309. It shall be unlawful for any person, firm or corporation to pile, or maintain a pile of, lumber or other materials of like combustible nature within the fire limits of the City of Chicago as the same are now or may hereafter be defined by ordinance, for the purpose of storing, drying or seasoning the same within one hundred feet of any building of class 2 (B), class 2 (C), class 3, class 4, class 5, class 6, class 7 or class 8, as classified in The Chicago Code of 1911, nor within fifty feet of any building of class 1 unless the walls of such building of class 1 shall be of masonry or concrete construction with incumbustible roof and all exposed windows, door and other openings fitted and protected with approved fire resisting wired glass in metal sash and frames or with metal or metal-clad shutters and doors, under which conditions lumber and like combustible material may be piled not closer than twenty-five feet to any such building."

Section 2. That Section 665 of The Chicago Code of 1911, as subsequently amended, be and the same is hereby repealed.

Section 3. This ordinance shall be in force and effect from and after its passage and due publication.

Ordinance passed March 30, 1914.

NOTE

In order to insure absolute accuracy and certainly correct legal designation, the editors of the Handbook have exercised every possible care in the presentation of the Building Ordinances, the copy being carefully checked over direct from the official minutes of the City Council, and presented exactly as passed. Architects will find that sections and paragraphs are correctly designated or numbered, which is not the case with some of the other publications of the Ordinance. The legal Ordinance is the one passed by the City Council, including all of their mistakes.

Several Ordinances pertaining to Buildings will be found at the end of the Building Ordinance on pages 159 to 165, inclusive. These Ordinances have to do with ERECTION AND LOCATION OF BUILDINGS, and have no special section numbers.

No expense has been spared to prepare what we believe to be a complete and comprehensive index of the Ordinance. Instead of following the old system of indexing each classification separately, we have provided one index to cover the entire Ordinance, which will doubtless prove more convenient than the former method.

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DEPARTMENT OF ELECTRICITY.

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NOTICE.

Particular attention is called to the different sections of the ordinance herein printed.

Permits will be issued only to Registered Electricians.

The use of electric current is prohibited previous to certificate or current permit being issued.

Conditions unsafe to life or property must be corrected within forty-eight hours.

Each building into which electric current shall hereafter be introduced shall have independent service from the street or alley, entering at right angles with the street curb, except where the service wires are placed in conduits complying with the rules of the department of gas and electricity; and no wires hereafter put up shall pass from one building to another through any party wall or along any building wall or over any roof or under any sidewalk, except where such conduits are used.

Temporary work must be inspected and approved before current is used.

Alterations to existing wiring must not be made without regular permit.

Permits issued by the Commissioner of Public Works for electrical work to be done on streets must be countersigned by the Commissioner of Gas and Electricity.

Violation of any of the Sections of this ordinance constitutes a misdemeanor and renders any person, firm or corporation liable to arrest and fine of not less than $50 or more than $100, also the cutting off and stopping of current used in violation until the provisions are complied with.

Ray Palmer.

Commissioner of Gas and Electricity.

SPECIAL SUGGESTIONS TO ARCHITECTS.

The Department of Electricity will **not allow more than sixteen (16) sockets to be attached to one circuit.**

Architects are urged to make definite specifications for electrical work, for the benefit of both the electrical contractor and the fixture contractor, specifying the number of outlets in each job for the electrical contractor to follow, and the exact number of 16-candlepower lamps to be used.

Frequently the fixture contractor installs more than twelve lights on a circuit, which is in violation of the city ordinances, and causes the consumer very much annoyance in getting electric current to his premises.

It is also suggested that the architects demand of the electrical contractor that he make up all connections and combinations relative to switches, complicated outlets, etc., leaving only two wires for the fixture hanger to make his fixture connections.

GENERAL SUGGESTIONS.

In all electric work conductors, however well insulated, should always be treated as bare, to the end that under no conditions, existing or likely to exist, can a grounding or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to the minimum.

In all wiring special attention must be paid to the mechanical execution of the work. Careful and neat running, connecting, soldering, taping of conductors and securing and attaching of fittings, are especially conducive to security and efficiency, and will be strongly insisted on.

In laying out an installation, except for constant current systems, every reasonable effort should be made to secure distribution centers located in easily accessible places, at which points the cutouts and switches controlling the several branch circuits can be grouped for convenience and safety of operation. The load should be divided as evenly as possible among the branches, and all complicated and unnecessary wiring avoided.

SPECIAL NOTICE.

Service switches, cutouts and meters must, when practicable, be placed in basements or other public portions of the building. Exception will be made for cutouts in the case of apartment buildings having 4 circuits or more per apartment or where the building is four stories or more in height. Where cutouts are located in apartments or on the various floors of residences, etc., they must never be located in clothes closets or any other location where combustible material is stored.

Meter outlet fittings must be of approved construction.

A separate fitting is required for each meter.

Meter fittings are required on all installations where the mains are of No. 2 B. & S. gauge or smaller. This includes both power and light.

On mains larger than No. 2 B. & S. gauge, conduit fittings, where wires leave the conduit system through separate insulated openings, must be used.

The meter fitting must be placed so that the opening for the wires is at the top of the fitting, except where the fitting is so constructed that the wires to meter leave at the side.

All wires from fitting to meters where liable to come in contact with wires or other materials must be protected by flexible tubing.

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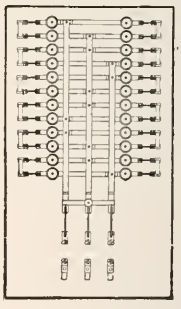

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Sections of the Chicago Code of 1911 of the City of Chicago Governing Electrical Inspections

Passed March 13, 1911.
Amended December 30, 1912; July 7, 1913; July 21, 1913; November 3, 1915

CHAPTER XXIV.

ELECTRICITY—ARTICLE 1.

DEPT. OF GAS AND ELECTRICITY.

830. **Electric Current.)** No electric current shall be used for lighting, heating or power purposes except as hereinafter provided.

831. **Applications—Contents—Permit.)** All persons or corporations desiring to install wires or other apparatus for the use of electric currents for any of the purposes mentioned in the foregoing section, shall before commencing or doing any electrical construction work of any kind whatever, either installing new electrical apparatus or repairing apparatus already in use, file an application for a permit therefor in the office of the Commissioner of Gas and Electricity, which application shall describe in detail such material and apparatus as it is desired to use, with a full description of the same, giving the locality by street and number, and countersigned by the person under whose supervision the work is to be done; and upon the filing of which application, if found proper, such permit shall be given. No such work shall be done unless under the supervision of a duly qualified person as provided in Section 831½.

831½. **Requirements for Registration of Applicant for Permit.)** Any person or corporation making application for permits must file with the Commissioner of Gas and Electricity an affidavit stating that the work to be done under such permits will be under the supervision of a person who is not less than twenty-one (21) years of age, who has a thorough knowledge of electrical construction, and who has had not less than four (4) years of practical experience in the installing of electrical wires and apparatus for the purposes mentioned in the foregoing section. Such affidavit must contain the name and signature of the person under whose supervision the work is to be done, together with two indorsements from responsible citizens, made under oath, that such person possesses the qualifications above mentioned. Upon the filing of such affidavit, if found proper, and upon the payment of a fee of twenty-five ($25.00) dollars to the City Collector, the Commissioner of Gas and Electricity shall issue a certificate of registration to such applicant, which shall entitle him to obtain permits to install electrical wires and apparatus as aforesaid for a period of one (1) year, provided that the fee to be paid to the City Collector, for a renewal of said certificate of registration, shall be ten ($10.00) dollars per year.

832. **Duties of Commissioner of Gas and Electricity Thereon.)** The said Commissioner of Gas and Electricity or his assistants shall have power, and it shall be their duty, when deemed necessary by the Commissioner of Gas and Electricity, to carefully inspect any such installation previous to and after its completion, and they shall have the right to enter any building when by them deemed necessary, to inspect any such installation, and it shall be competent for them to remove any existing obstructions which may prevent a perfect inspection of the current carrying conductors, such as laths, plastering, boarding or partitions; and it shall be unlawful for any person to interfere with them in the performance of their duties; and if such installation shall prove to have been constructed in a safe and secure manner, upon the payment of a fee, as hereinafter provided, the Commissioner of Gas and Electricity shall issue a certificate of such inspection, which shall contain a general description of the installation and the date of such inspection. Any owner installing or causing to be installed any electric wires to be hidden from view shall, prior to such installation, give said Commissioner of Gas and Electricity a reasonable notice in order to give ample time for inspection. The use of electric current is hereby declared to be unlawful previous to the issuance of such certificate; provided, however, the Commissioner of Gas and Electricity may issue a temporary permit for the use of electrical current during the course of construction or alteration of buildings, which permit shall expire when the electrical apparatus for such building is fully installed. The head of the department issuing such permit, where a deposit is required to cover inspection fees or for other purposes, may receive a single deposit to cover the liability of one or a number of different persons, firms or corporations, as imposed by the ordinance of the City of Chicago, and in such case shall, at the time of receiving such deposit, enter into an agreement with the persons, firms or corporations, on behalf of whom said deposit is made, wherein among other conditions it shall be stated the purpose for which said deposit is made and on whose behalf, and such agreement shall provide that in case said deposit is anywise depleted to the extent of twenty-five per cent (25%), the persons, firms or corporations on whose behalf said deposit is made shall, within three days after notice of such depletion given by the head of such department to any one of such persons, firms or corporations on whose behalf said deposit is made, deposit a sufficient sum to replenish said fund so that the amount shall be equal to that originally deposited; and, provided, whenever any notice to replenish a deposit shall have been given as herein provided, and said deposit shall not be replenished as herein provided, no permit shall thereafter issue to any of the persons, firms or corporations on whose behalf said deposit was made, unless such person shall first deposit a sum as provided by the ordinances pursuant to which such permit is issued

833. **Certificate—Wiring Only and Complete Installations.)** A final certificate for wiring only may be issued by said Commissioner of Gas and Electricity in the case of completed wiring installation, but upon which no current shall be used in the immediate future. Such certificate shall show that at the date of inspection the installation was constructed and erected in accordance with the terms of this chapter, and shall be is-

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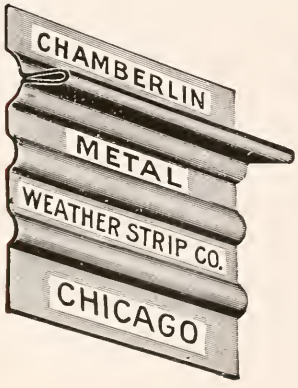

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sued at nine-tenths the rates hereinafter named for complete installation.

Prior to the introduction of electric current into the said premises a second inspection shall be made, when, if the said installation be still in accordance with the provisions of this chapter, and the fixture work be correct, a final certificate for complete installation and service shall be issued and the amount of the fee paid for the final certificate for wiring only shall be deducted from the fee for the final certificate for complete installation and service.

834. **Power of Commissioner of Gas and Electricity—Inspections and Re-Inspections.)** The said Commissioner of Gas and Electricity is hereby empowered to inspect or reinspect all overhead, underground and interior wires, and apparatus conducting electric current for light, heat, or power, and when said conductors or apparatus are found to be unsafe to life or property, he shall notify the person or corporation owning, using or operating them to place the same in a safe and secure condition within forty-eight hours. Any person or corporation failing or refusing to repair, change or remove the same within forty-eight hours or within such further time as the Commissioner of Gas and Electricity shall determine is necessary, after the receipt of such notice, shall be subject to the penalty hereinafter provided.

834½. **Power of Commissioner of Gas and Electricity to Call Upon Police for Assistance.)** Whenever it shall be necessary in the opinion of the Commissioner of Gas and Electricity to call upon the department of police for aid or assistance in carrying out or enforcing any of the provisions of the City of Chicago governing electrical inspections, he shall have authority to do so, and it shall be the duty of the department of police or any member of said department, when called upon by said Commissioner of Gas and Electricity, to act according to the instructions of and to perform such duties as may be required by said Commissioner of Gas and Electricity in order to enforce or put into effect the provisions of these rules and regulations.

835. **Poles—Covers—Wires—Electric Service Entrances—Switches.)** All poles now standing or hereafter erected and all covers for manholes now in service, or hereafter placed in service for the use of electric conductors, shall be branded or stamped with the name of the person or corporation owning the same; all electric service entrances shall have attached to the conductor or conductors, in a conspicuous place, a substantial tag designating the owner, and giving such a full description of the conductors as shall meet with the approval of said Commissioner of Gas and Electricity; and all of said electric service entrances shall be properly equipped with approved cutout service switches. Each building into which electric current shall hereafter be introduced shall have independent service from the street or alley, entering at right angles with the street curb, except where the service wires are placed in conduits; and no wires hereafter put up shall pass from one building to another through any party wall or along any building wall or over any roof or under any sidewalk, except where such conduits are used.

836. **Fees.)** There shall be collected by the City Collector for completed installations, prior to the issuance of certificate permitting the use of electric current, the following fees, in the following manner:

For the inspection of each of the first two arc lamps, one dollar; for three arc lamps, two dollars and eighty cents; for four arc lamps, three dollars and sixty cents; for five arc lamps, four dollars and forty cents; for six arc lamps, five dollars and ten cents; for seven arc lamps, five dollars and eighty cents; for eight arc lamps, six dollars and fifty cents; for nine arc lamps, seven dollars and twenty cents; for ten arc lamps, seven dollars and ninety cents; for above ten to twenty arc lamps, sixty cents each; twenty arc lamps, thirteen dollars and ninety cents; for above twenty to thirty arc lamps, fifty cents each; for thirty arc lamps, eighteen dollars and ninety cents; for above thirty arc lamps, twenty-five cents each.

For incandescent lamps consuming nominally fifty watts each as follows: For each of the first twenty-five incandescent lamps, ten cents; for each of the next twenty-five lamps, nine cents; for each of the next twenty-five lamps, eight cents; for each of the next twenty-five lamps, seven cents; for each of the next one hundred lamps, six cents, for each of the next one hundred lamps, five cents; for each additional lamp above three hundred, four cents; and for larger and smaller lamps under five hundred watts in the same proportion.

For the inspection of incandescent lamps consuming five hundred watts and over: For each of the first two lamps, one dollar; for each of the next three lamps, eighty cents; for each of the next five lamps, seventy cents; for each of the next ten lamps, sixty cents; for each of the next ten lamps, fifty cents; for each additional lamp above thirty, twenty-five cents.

For each electrical horse power of seven hundred and forty-six watts used for mechanical or other purposes than above mentioned, the sum of one dollar for each horse power from one to five horse power, inclusive; for each of the next succeeding five horse power, seventy-five cents; for each of the next succeeding five horse power, sixty-five cents; for each of the next succeeding ten horse power, fifty-five cents; for each of the next succeeding twenty-five horse power, fifty cents; for each of the next succeeding two hundred horse power, twenty-five cents; for each of the next succeeding two hundred and fifty horse power, ten cents; and for each additional horse power, five cents.

No inspection shall be made for a less amount than one dollar.

Inspections of electric lights, other than electric signs as herein defined, placed on a public street or alley for the purpose of illuminating the same; temporary installations for show window exhibitions, conventions and the like; underground or overhead wires and apparatus; and all other inspections not specifically provided for herein shall be charged for according to the time required for such inspections at the rate of seventy-five cents per hour.

Each reinspection of any overhead, underground or interior wires or apparatus shall be charged for according to the time required for such reinspection at the rate of seventy-five cents per hour.

On each installation where a permit has been issued and work not sufficiently completed within three months for wiring only certificate to be issued, and where inspection has been made on such work, a portion of the regular fee must be charged to cover the cost of such inspection, which will be credited on the final certificate.

Immediately after the inspection provided for in Section 832, the Commissioner of Gas

Bell

System

Architects and Builders

are invited to consult the
Engineering Department of the

Chicago Telephone Company

when making studies of new buildings or of structures to be remodeled.

Our engineer will assist in the preparation of conduit plans and make suggestions regarding new installations. This service will save time and possible complications and is rendered without charge.

(See pages 173 and 175)

Call
Official 300 Local 671

Chicago Telephone Company
Bell Telephone Building

and Electricity shall make a fee bill, in duplicate, on a form to be approved by the City Comptroller, and shall forward the same to the Comptroller to be recorded and rendered. The person, or corporation, receiving the fee bill shall pay the amount thereof to the City Collector, who shall endorse payment thereon and enter the fee bill and payment in a book in his office, to be provided for that purpose, and thereupon the City Collector shall deliver the paid fee bill to the person or corporation paying the same. The paid fee bill shall then be presented to the Commissioner of Gas and Electricity at his office and thereupon the Commissioner of Gas and Electricity shall issue the writing only or final certificate for completed installation provided for in Section 833.

837. **Alterations.)** No alterations shall be made in any electrical installation without first notifying the said Commissioner of Gas and Electricity and submitting the same for inspection in the same manner as provided for new work.

838. **Duty to Test Meters.)** Electrical meters will be tested upon filing proper application with Department of Gas and Electricity.

* * * * * *

848. **Penalty.)** Any person or corporation who shall violate any of the provisions of this article or who shall furnish or use any electrical current or install any electrical wires or apparatus shall be fined not less than fifty dollars nor more than one hundred dollars for each offense, and each day's use thereof contrary to the provisions of this Article shall constitute and be a separate and distinct offense. Said Commissioner of Gas and Electricity may, for any violation of the provisions of this Article, also order and compel the cutting off and stopping of such current until the provisions of this Article are fully complied with.

Table of Allowable Carrying Capacities of Wires.

a. The following table, showing the allowable carrying capacity of copper wires and cables of ninety-eight per cent conductivity, according to the standard adopted by the American Institute of Electrical Engineers, must be followed in placing interior conductors.

For insulated aluminum wire the safe carrying capacity is eighty-four per cent of that given in the following tables for copper wire with the same kind of insulation.

B. & S. G.	Table A. Rubber Insulation. Amperes.	Table B. Other Insulations. Amperes.	Circular Mils.
18	3	5	1,624
16	6	10	2,583
14	15	20	4,107
12	20	25	6,530
10	25	30	10,380
8	35	50	16,510
6	50	70	26,250
5	55	80	33,100
4	70	90	41,740
3	80	100	52,630
2	90	125	66,370
1	100	150	83,690
0	125	200	105,500
00	150	225	133,100
000	175	275	167,800
0000	225	325	211,600
Circular Mils.			
250,000	240	350	
300,000	275	400	
350,000	300	450	
400,000	325	500	
500,000	400	600	
600,000	450	680	
700,000	500	760	
800,000	550	840	
900,000	600	920	
1,000,000	650	1,000	
1,100,000	690	1,080	
1,200,000	730	1,150	
1,300,000	770	1,220	
1,400,000	810	1,290	
1,500,000	850	1,360	
1,600,000	890	1,430	
1,700,000	930	1,490	
1,800,000	970	1,550	
1,900,000	1,010	1,610	
2,000,000	1,050	1,670	

Materials.

The following is a list of non-combustible, non-absorptive, insulating materials for the benefit of those who might consider hard rubber, fiber, wood and the like as fulfilling the requirements:

1. Glass.
2. Marble (filled).
3. Slate without metal veins.
4. Porcelain, thoroughly glazed and vitrified.
5. Pure sheet mica.
6. Lava (certain kinds of).
7. Alberene stone.

Electric Gas Lighting.

a. Electric gas lighting, unless it is the frictional system, must not be used on the same fixture with the electric light.

SUGGESTIONS FOR THE PROVISIONS OF WIRING AND CABLING OF BUILDINGS FOR SERVICE OF CHICAGO TELEPHONE CO.

The extensive use of the telephone in office buildings, hotels and large apartment buildings renders it essential that a provision be made in all modern buildings of these types, in advance of their completion, for carrying the requisite number of wires necessary for furnishing telephone service.

Where a private branch exchange switchboard or a building basement terminal is installed it is necessary to carry at least two wires from each telephone to the central distributing point in the building. Where these buildings are furnished telephone service by means of cable it is generally necessary to extend a building cable and establish one or more branch terminals, from which the distributing wires are taken. Hence, the importance of making adequate provision in advance for such building cabling and wiring.

It is advisable to have such provision included in the building plans. Otherwise the walls may be disfigured by unsightly open wire runs, or it will be necessary to make openings through the walls, floors and partitions after the completion of the building.

The Telephone Company will be pleased to furnish the owner or architect with all necessary information as to size, type and location of conduits. Building wiring may be logically divided as follows:

(1) APARTMENT BUILDINGS.

The term apartment buildings as used herein means buildings larger than single houses or stores and smaller than office buildings. Such buildings may contain living and office apartments, also stores, generally on the ground floor.

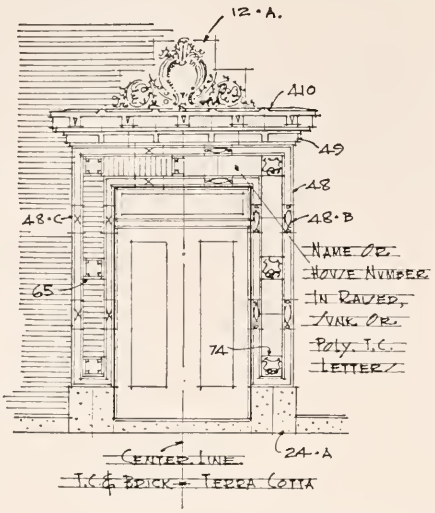
In an apartment building the maximum number of telephones in any one apartment, or on any floor, is quite definitely fixed, generally one per apartment.

Vertical building conduit, with an outlet at each floor, should be installed in each tier of apartments in an apartment building.

(2) OFFICE BUILDINGS.

The wiring of an office building presents a difficult problem for the following reasons:

The number of telephones will depend largely upon the character of the business and district. The number of telephones on any floor of these buildings will depend upon the requirements of the individual tenants.



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CENTRAL 812

ADVANCE TERRA COTTA COMPANY

ARCHITECTURAL TERRA COTTA

29 SOUTH LA SALLE ST., CHICAGO

ESTIMATES PROMPTLY FURNISHED

This is not constant for any extended period, as tenants may from time to time be replaced by others using more or less service.

In office buildings where the floor is likely to be divided into a large number of rooms or offices the distributing wires from the floor terminals to telephones can be run in moulding. The floor terminals should be located near the ceiling. A suitable moulding should be provided in the halls for carrying the wires from the terminal boxes to the various rooms. A smaller moulding should also be provided in the individual rooms, or suites of rooms, for carrying the wires to the proper location desired.

At certain intervals, depending upon the arrangement of the building in question, it will be desirable to have a piece of conduit extend across the ceiling of the hall in order to distribute from the floor terminal on one side of the hall to the rooms on the other side of the hall, in case there is no terminal on the other side.

With the system above described, the wiring is practically concealed and the system is flexible enough to allow proper distribution of facilities among the various rooms on the floor.

In large office buildings it is necessary to have a cross connecting rack — to afford means for getting connections between different floors. In the case of very large buildings a small room should be designed for this in the basement.

in either the office building class or the apartment building class or a part of both.

Where a very large use of telephones is contemplated, outlets may be placed in the floors on approximately five-foot centers, which outlets are connected to distributing centers by a lateral system of ducts or iron conduits.

The telephone system installed in hotel buildings consists of a telephone switchboard located at some convenient point, usually on the ground floor, in or near the office. Telephones are placed in each room or suite and wired to the switchboard, which is connected by one or more trunk lines with the nearest exchange of the Telephone Company. The wiring problem is, therefore, comparatively simple, involving the running of a pair of wires from some definite point in each room or suite to a common center near the switchboard location. Provision should also be made so that the Telephone Company can run its trunk wires from the switchboard to the point at which the telephone cable enters the building from the street, usually in the basement. A two (2) inch conduit is frequently sufficient for this purpose.

The method of getting wires from the common point (switchboard) up through and to the various floors, also the provision for terminating service cables, is the same as above described for cabling of office buildings.

From the floor terminal a conduit one-half (½) inch inside diameter is run to a designated location in the wall of each room in

Cable.	Twisted Pairs.	Conduit Straight Run Less than 75′.	Conduit Straight Run More than 75′.	Conduit Run Less than 75′. One 90° Bend.	Conduit Run More than 75′. One 90° Bend.	Outside Diam. of Cable.	Size of Pull Boxes.
	2	½″	½″	½″	¾″		4″x4″ 2″ deep
	4	¾″	¾″	¾″	¾″		6″x18″ 4″ deep
25-pr.		1″	1″	1″	1¼″	23/32″	6″x20″ 4″ deep
50-pr.		1¼″	1½″	1½″	1½″	29/32″	6″x20″ 4″ deep
100-pr.		1½″	2″	2″	2″	1 3/16	8″x24″ 6″ deep
200-pr.		2½″	2½″	2½″	2½″	1¾″	10″x30″ 8″ deep
300-pr.		3″	3″	3″	3″	2 1/16″	12″x32″ 8″ deep
400-pr.		3″	3″	3″	3″	2⅜″	12″x32″ 8″ deep
600-pr.		3½″	3½″	3½″	3½″	2¾″	12″x36″ 10″ deep

Conduits smaller than 1″ are objectionable for lead covered cable because they are frequently deformed during construction of building.

All runs exceeding 100 feet in length
All runs having more than two 90° bends
All runs having bends sharper than 90°
} should be provided with pull boxes.

When an entire office building, or several floors of a large building, is devoted exclusively to the purposes of one firm, some floors are generally not subdivided into small rooms, yet it is necessary to supply telephone service to many desks in the large rooms, and it is desirable to have the telephone wiring concealed.

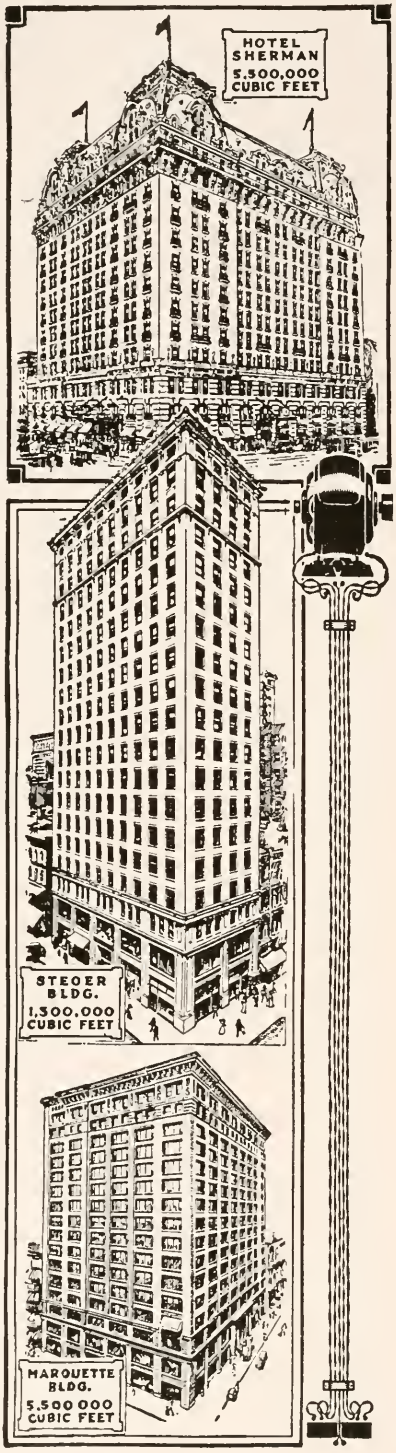
If the room has columns and the desks can be grouped along the walls and about the columns, outlet boxes can be placed adjacent to these groups of desks and these outlets connected to distributing centers by iron conduits, as described under "Hotel" wiring.

Where a very large use of telephones is contemplated, outlets may be placed in the floors on approximately five-foot centers, which outlets are connected to distributing centers by a lateral system of ducts or iron conduits.

(3) HOTELS.

Depending upon the size and location, type and kind of building and character of service contracted for, a hotel may be included

which a telephone is to be placed. The height of the outlets in each room should be about five (5) feet from the finished floors; this will depend largely upon the desire of the hotel architect or owner. A one-half (½) inch (inside diameter) conduit should not be over fifty (50) feet in length, nor have more than three bends with a minimum radius of five (5) inches. Any conduit one hundred (100) feet in length should not be less than one (1) inch inside diameter. One-half (½) inch (inside diameter) conduit should be provided for a maximum of two pairs of wires; three-quarters (¾) inch (inside diameter) conduit for five pairs; and one (1) inch (inside diameter) conduit for nine pairs. In extending conduit from terminal boxes to rooms it is possible in many cases to use one run of larger conduit to supply three or four rooms, rather than run smaller conduit to each individual room. When the floor area and the number of rooms are large it may be found economical to have more than one terminal box on a floor.



It is A Proven Fact that Central Station Service Excels

Most of Chicago's largest and best buildings recognize this fact and buy all their electricity from the Commonwealth Edison Company. They find this service a decided economy and most efficient in every way.

Such structures as hotels and modern office buildings that must be free from noise, smoke, ashes and vibration, and those buildings in which the tenants require power that is constant, free from fluctuations, and ready at all times, have adopted Central Station Service.

The buildings shown at the left use Edison service exclusively for light and power.

'Phone Randolph 1280
Contract Department

Commonwealth Edison Company

120 West Adams Street

346

REGULATIONS GOVERNING COMMONWEALTH EDISON CO.'S SYSTEM.

INTRODUCTORY.

These Rules and Regulations are supplementary to the Electrical Code of the City of Chicago and do not intentionally conflict with that Code in any respect.

All registered electrical contractors in Chicago have been provided with a copy of our Rules and Regulations. When making contracts for electrical wiring or apparatus, it is recommended that the specifications include the requirement that the Rules and Regulations of this Company shall be conformed to.

The Company is desirous of serving its customers promptly and satisfactorily. It will endeavor to co-operate with contractors and customers to the fullest extent in completing service connections with as little delay and inconvenience as possible, and will gladly give especial attention to any particularly difficult situation confronting a customer.

Anyone desiring information relative to new customers or to additional service at a location already served by the Company should call at the Company's office, or telephone Randolph 1280 and inquire for "Application Bureau."

Anyone desiring information relative to the location of street mains, service outlets or meters, kind of service (direct current or alternating current, single phase or three phase), or similar technical matters, should call at the Company's office, or telephone Randolph 1280, and inquire for "Distribution Division."

Anyone desiring to give or receive information relative to lamp renewals, minor repairs or any interference with the supply of electricity, should call at the Company's office, or telephone Randolph 1280, and inquire for "Service Bureau."

Certain useful information relating to the character of the service in different parts of the City and to the appropriate size and arrangement of meters and service cutouts is included in this book for the convenience of customers and contractors.

SYSTEMS OF DISTRIBUTION.

Electricity is delivered to customers of the Company by three different systems, viz.:

1. Direct current three-wire Edison, operating at approximately 115-230 volts, for light and power.

2. Alternating current, sixty cycle, single phase, three-wire Edison, operating at approximately 115-230 volts, for light and small power.

3. Alternating current, sixty cycle, three phase three-wire, operating at approximately 230 volts, for power only.

Direct Current Territory.

Electricity is supplied from the Edison three-wire direct current system in approximately the following territory:

North Side. South of Wisconsin Street, east and north of the Chicago River.

West Side. West of the Chicago River to Racine Avenue between Grand Avenue and 16th Street, except on Milwaukee Avenue, where the direct current extends to Wood Street; on West Madison, where it extends to Ashland Avenue, and on Blue Island Avenue, where it extends to Throop Street.

South Side. From the Chicago River to 35th Street between Stewart Avenue and Cottage Grove Avenue. From 35th Street to 39th Street between Dearborn Street and Grand Boulevard, and on Cottage Grove Avenue from 35th to 38th Streets.

Alternating Current Territory.

Electricity is supplied from the alternating current Edison three-wire system for lighting and small power in all other parts of the city where the Company has mains.

It is important that inquiry be made at the Distribution Division of the Company as to the character of the service which will be given in locations which are near the dividing lines above described, as these boundaries are subject to change at any time and alternating and direct current lines overlap each other in some places.

SERVICES.

It is essential, in order to avoid error, that the customer inform himself at what point the Company's service lines are to be brought to his building. In order to assist the customer in securing such information, special forms have been provided which can be secured upon request. The Company, on receipt of one of these forms properly filled out, will designate the point of service entrance and also the character of service to be supplied.

The Company will not be responsible for mistakes of any nature whatever, resulting from information relative to the character of its service or location of its mains given verbally or over the telephone unless such information is confirmed in writing by the Company.

Three-Wire Edison System.

Lighting installations which exceed 1,200 watts in capacity, except in houses and apartments, must be provided with three-wire mains, from the service to the centers of distribution, the branch circuits being balanced as nearly as possible at these points.

House and apartment lighting installations which exceed 1,800 watts in capacity must be provided with three-wire mains.

Single stereopticons, outlets for battery charging and devices which are most economically operated at 115 volts may be so operated provided the energy required by a single device does not exceed 4,000 watts. Where more than one such device is installed in the same premises they must be connected to a three-wire main and balanced as nearly as possible.

In motion picture theatre installations the exterior lighting should be balanced against the interior lighting with the moving picture and spot arcs on the same side as the interior lighting.

Single phase motors, moving picture and spot arcs in such theatres should be connected to the same meter.

Three-wire service switches or cutout blocks for branch mains, except three phase, must have no fuse in the neutral wire.

Overhead.

The customer's wiring must be brought outside of the building wall at a point which will be as accessible as possible to the Company's distributing line. If possible, the position of the outlet should be such that service wires can be brought from the Company's nearest pole without crossing the adjacent property.

For buildings of more than one story in height, the service outlet must be brought at least to the level of the ceiling of the second floor, and for buildings of less than two stories in height, must be carried to the highest point of that part of the building at which such outlet is located.

The service outlet must be so located that there will be at least 24 inches clearance between it and any telephone or signal wires attached to the building and at least 36 inches clearance between the service drops of both systems.

The service wires must, in no case, be within easy reach from porches, windows or any other part of the building ordinarily accessible to the occupants.

In case a pole line from which service is to be given is not in position at the time the interior wiring is being done, inquiry should be made at the Inspection Bureau of the Company for information as to the probable location of the service outlet.

Separate services will not be installed for several buildings on the same premises and under the same ownership except at the customer's expense.

Where a customer desires to equip an outbuilding with a lighting installation of 300 watts in capacity, or less, the out-building must, if practicable, be connected to the meter for the principal building. If it is impracticable to run a service line from the building in which the meter is located to such out-building, the Company will install a separate service connection at the customer's expense.

Underground.

Underground service cables are brought three feet inside the curb wall where there is an excavation below the sidewalk or inside the building wall where there is no such excavation and the basement of the building adjoins the property line. The customer must extend his wiring to the nearest existing service if there be one within fifty feet of his building. Where there is no building on the property line, the Company will bring the service to a pole, to be installed on the customer's property, if the customer is willing to permit such installation. Otherwise the service will be extended underground into the premises—the Company bearing only the expense of that portion of the line which is in the street or alley and of 10 feet of that portion of the line which is in the customer's property. Where service is installed on a pole from an underground main the expense of the connection from the pole to the building must be borne by the customer unless he is willing to permit the Company to make use of the pole for the purpose of connecting other buildings in the vicinity. Where there is no service within 50 feet of the customer's premises application should be made to the Inspection Bureau to have a service connection installed. If there is no distributing main available application should be made to the Contract Department to have the lines extended.

Where the customer desires to install underground service wires in a territory supplied by overhead lines, conduit must be installed by the customer from the building to the base of the pole from which the service is to be taken, and a length of lead-covered cable must be furnished sufficient to extend from the service switch to the cross-arm on the pole. The Company will install the conduit from the base of the pole to the cross-arm and make the final connection between the underground cable and the overhead wires.

METERS.

Location.

All meters must be installed in a suitable location as near as practicable to the point where the service enters the building. The wires should be enclosed in a continuous metal conduit from the service to the meter. In office buildings, special meter closets of ample size should be provided on each floor; in apartment buildings, all meters should be installed in the basement, and the separate circuits to each apartment should be carefully labeled. In residences, meters should be installed in the basement or a rear hall, rather than the attic.

The requirements of a suitable meter location are as follows:

(a) Meters should be accessible to the Company's employees at all times, and should be so located that they may be easily read, inspected and tested, with a minimum of annoyance to the tenants. They must be installed not more than seven feet from the floor, and must not be placed in bedroom closets, bath or toilet-rooms, or in any room commonly kept locked, in or near coal-bins, over doors, in elevator or ventilating shafts, near stoves, radiators, or steam or gas piping.

(b) The location selected must be free from moisture. A watt-hour meter must never be placed under a water pipe, from which, as a result of sweating, water may drip. When a damp location is unavoidable, a moisture-proof cabinet must be provided by the customer to contain the meter.

(c) The location must be free from vibration. Where a building faces on a street on which traffic is heavy, or cars are passing, meters should preferably be placed upon a wall at the building line, rather than upon the front curb wall. They must not be placed on any insecure partition. The placing of a meter over a doorway is not permitted.

(d) Watt-hour meters should be located if possible so that they will not be exposed to mechanical injury. If it is necessary to locate the meter where it is liable to mechanical injury, a strong cabinet must be provided by the customer to contain the meter, and to thoroughly protect it from possible damage. In connection with mechanical injury, a meter should not be placed near the floor, but if circumstances make it impracticable to install otherwise, an en-

closure must be provided so as to protect the meter from any damage.

(e) The meter location must be as free as possible from magnetic disturbance. Meters must not be installed in close proximity to motors or generators. Meters for direct current must not be located in iron or steel cabinets. Asbestos board or non-magnetic metal cabinets must be used.

Meter cabinets must be of ample size to permit the safe handling of wires when connecting, disconnecting or testing the meters. If the conditions require the installation of a metal cabinet, one completely insulated on the inside should be used.

Installation.

Meter loop fittings are required by a city ordinance to be provided on all installations where the mains are of No. 2 B. & S. gauge or smaller. On mains larger than No. 2 B. & S. gauge conduit fittings or standard meter loop fittings of proper capacity must be used.

A type of meter loop fitting is recommended in which the wires between the fitting and the meter are protected with a metal housing and embodied in which is a meter test block. This type of fitting renders the customer's installation less liable to disturbanee and his service is not interrupted by meter testing operations.

Where meter loops are provided, a free end of at least 24 inches must be left to give ample wire for connection to the watt-hour meter, or if the wires are left in the form of loops, each loop must contain at least 48 inches of wire.

Meter loops must be so arranged that the meters can be placed at least 6 inches away from iron cabinets and cutout boxes, to permit the safe handling of wires during tests and inspections.

The meters must be placed with a distance between centers of not less than 12 inches for A. C. and 15 inches for D. C. meters. Meters of a capacity in excess of 50 amperes, should have a distance between centers of not less than 24 inches, and the leads of one meter or common conductor should not run within 12 inches of another meter.

The general arrangement of meter loops should, if possible, be such that a meter can be installed without crossing any wires. If this is impracticable, sufficient flexible tubing must be left on the wires to make possible an installation which will be in accordance with the Electrical Bureau Rules of the Department of Gas and Electricity of the City of Chicago.

When meters are installed for construction work, they must be placed in cabinets of moisture-proof construction, provided by the customer, so as to protect them against injury. The Company will provide an independent cabinet for its service switch and service fuses, and each individual sub-contractor is required to provide his own meter cabinet and make the necessary connections between this cabinet and the service switch cutouts. When it is not possible to select a permanent location for the meter at the outset, the customer must arrange for the relocation of the cabinet and meter connections whenever the cabinet is moved.

Where several meters are grouped together, the circuit to which each one is connected should be plainly indicated, and all circuits should be carefully traced to insure that there is no error in the wiring, whereby one customer obtains current through another customer's meter.

Both sides of a 220 volt, two-wire alternating current circuit must be carried through the meter. This practice should also be followed on direct current, two-wire circuits, for meters up to and including 50 amperes capacity.

Both outside wires of all 230 volt, three-wire circuits must be carried through the meter and, in the case of direct current installations, a neutral potential tap must also be provided.

Potential taps must be so made that they cannot become disconnected. This precludes the use of fuses on all potential taps. The connecting wire should be as short as possible, and must be soldered to the return or neutral circuit.

All watt-hour meters and maximum demand indicators must be protected by suitable fuses. Meters must never be placed between the service mains and the service switch.

In all apartment or office buildings fuses must be provided in such a manner as to protect the meter where a group of more than six apartments or offices is dependent on the service switch or branch block.

Under ordinary conditions, the Company will install in the customer's premises for one class of service, only one meter or one unified set of meters. In this connection, it is to be noted that in apartment buildings only one meter will be installed for hall lighting for adjacent buildings under one ownership.

A rental charge of $0.50 per month per watt meter is made by the Company, where, at the request of the customer and for his convenience, more than one meter is installed on his premises for one class of service.

Where the Company furnishes electricity under its rate for large users provision must be made by the customer at the service entrance for the installation of one set of meters for the measurement of all electricity for both light and power. In the case of alternating current service, however, a separate meter may at the option of the Company be installed for the lighting service.

Information relative to the type of watt-hour meters and maximum indicators to be used on these installations should be obtained from the Company before the wiring is completed.

No meter will be installed in such a manner as to record the consumption of electricity which has already been recorded by another meter on the premises.

A suitable meter board not less than ⅞-inch thick must be provided by the customer. Specifications, prepared by the Department of Gas and Electricity of the City of Chicago, show the necessary dimensions of these boards for installations of outlet fittings, watt-hour meters, and maximum demand indicators, under 100 amperes capacity.

Types and Dimensions.

The Company should be consulted whenever it is necessary to know in advance the type and size of the meter which a given installation will require, as considerable experience is necessary for the proper assignment of meters for different classes of installations.

Standard three-wire meters are used only where the capacity of each side of the three-wire system is 150 amperes or less. Installations requiring meters of larger capacity will be provided with two meters, one on each side of the three-wire system.

Demand indicators are not usually installed on installations under 1½ kilowatts. Two maximum demand indicators are installed on three-wire circuits.

Current transformers, in connection with five ampere meters, are used on all alternating current installations, when the load is in excess of 150 amperes, and potential transformers are used on all installations on primary lines. Space should be allowed accordingly, in arranging meter boards.

Standard front connected types of meters are used up to a capacity of 600 amperes. Larger meters are usually back-connected switchboard type For installations requiring a meter capacity of over 1500 amperes it is customary to install two or more meters in multiple.

Switchboard Meters.

When arrangements are made with the Company in advance, switchboard meters will be furnished for large installations.

Sufficient space must be provided on the switchboard so that the watt-hour meters can be installed with all parts accessible, and a clearance of 6 inches must be left below all type C-S and G-3 General Electric Company watt-hour meters, to allow for the removal of the iron magnet shield when testing.

When meters are placed on switchboards, the necessary drilling must be done by the customer. The proper templates and wiring diagrams will be furnished by the Company upon request.

Suitable testing links which are accessible at all times must be installed on the load side of all switchboard meters. When three-wire meters are installed, an additional testing link is required on one of the service leads.

It is desirable to have the testing links located on the front of the switchboard, whenever practicable to do so.

All nuts which it is necessary to remove or loosen when the meter is to undergo a test, should thread upon steel bolts or studs. The studs and nuts should be proportioned in cross section and in size in accordance with the capacity of the meter and each stud should have sufficient length to enable the nut to hold a ⅜-inch testing connection rigidly.

Demand indicators, printometers, clocks, switches, and maxicator motors are part of the meter equipment, and drilling for them must be done by the customer. Drilling templates and wiring diagrams will be furnished by the Company upon request.

It is highly desirable that blue prints or sketches, showing location and arrangement of meters on switchboards, be submitted to the Company for approval before the watt-hour meters or other instruments are ordered, or the construction of the board commenced.

MOTORS AND WIRING.

Alternating Current.

In general, wiring should be so arranged that all motors of ¾ H.P. or more may be connected to a service and meter separate from the lighting installation except as hereinafter specified.

Motors larger than ¾ H.P. must be wound for 230 volts and 60 cycles.

No motors larger than 5 H.P. will be supplied on the single phase system except by special permission given in each case by the Inspection Bureau of the Company.

Three-phase service will not be installed for installations aggregating less than 5 H.P. unless the customer first deposits with the Company a sum equivalent to the excess cost to the Company of installing a three-phase service over and above the cost of installing a single-phase service. In case the customer's power installation shall subsequently be increased to a total rated capacity of 5 H.P. or more, the Company will return the amount of the deposit to the customer.

Motors of 5 H.P. or more are supplied from the three-phase system in a large part of the alternating current territory, but inquiry should be made of the Distribution Division of the Company as to the proximity of three phase lines to any particular location where such power may be desired.

All motors of 7½ H.P. rating, and above, must be equipped with starting apparatus.

Motor starting equipments must be so arranged that in case of an interruption of the power supply the connections will be thrown to the starting position or the circuit opened entirely.

Motors of 50 H.P. and larger must be of the slip ring or wound rotor type. Squirrel cage type motors may be used to drive direct current generators if permission is secured in advance from the Inspection Bureau. Such permission will be granted only where the lighting service in the locality will not be seriously disturbed.

No motor will be connected which requires more than three times the full load current in starting.

The power factor of all motors or other inductive apparatus must be at least 80% when operating at their rated load.

Small alternating current motors which operate intermittently and start frequently, such as coffee mill, meat grinder, shoe repairing machinery, electric piano, peanut or popcorn roaster, beer pump, carbonator, and similar apparatus must be designed for and operated on 230 volt service.

Vacuum cleaner and pump motors in houses and apartments may be connected to the lighting mains if operated at 230 volts.

Vacuum cleaner motors of over 1 H.P. which are used in apartment buildings should be so wired that a separate meter can be installed.

440 volt service will be furnished by the Company only for power installations where there is an aggregate rated motor capacity of 250 H.P. or more.

In the case of motors operating hoists, elevators, welding machines, furnaces and other installations of like character, where the use of electricity is intermittent or subject to violent fluctuation, the Company reserves the right to require the customer to provide, at his own expense, suitable equipment to reasonably limit such intermittence or fluctuation.

Direct Current.

Direct current motors larger than 1 H.P. must be operated at 230 volts.

In the case of motors operating hoists, elevators, welding machines, furnaces and other installations of like character, where the use of electricity is intermittent or subject to violent fluctuation, the Company reserves the right to require the customer to provide, at his own expense, suitable equipment to reasonably limit such intermittence or fluctuation.

Cutouts.

Service switches and cutouts must be equipped with fuses and plugs of the proper size at the time of their installation.

Service switches and cutouts must not be installed in the vicinity of sinks, laundry tubs, water troughs or any other location where, due to moisture, current can be communicated through the floors or walls in the vicinity of such service switches or cutouts. The switch or cutouts should be so placed that any person having occasion to work on this equipment cannot come in accidental contact with the sink, water trough, laundry tub and such receptacles.

In cases where cartridge fuses are installed, the Company will not furnish free renewals.

Voltage Regulation.

The wiring installed in a customer's premises should be of such capacity that the entire connected load can be carried with a loss in voltage of not more than 2% between the service entrance and the most remote lamp on the premises.

Sockets.

All sockets must be designed for use with Edison base lamps.

SWITCH-BOARDS.

Specifications and blue prints for service and meter switch-board installations should be submitted to the Inspection Bureau of the Company for approval before construction on the switch-board is begun. Such switch-boards must be provided with suitable meter test links so placed that they will be readily accessible to the meter tester. Test links should also be placed at a sufficient distance from other bus bars and the switch-board frame to eliminate the risk of accidents from short circuiting as far as possible. Fuses should be so arranged that they will be readily accessible for the purpose of replacement. The general arrangement of the connections on the back of the board should be such as to make it possible to make repairs or alterations with a reasonable degree of facility and safety while the board is in service. The arrangement of the feeder cables between the terminal of the conduit system and the back of the switch-board should be made in a systematic and orderly manner and the cables should be segregated as far as possible with a view of minimizing the spread of fire in case of a short circuit.

LAMPS.

Contractors' Lamps.

In the case of buildings under construction, arc or incandescent lamps will be furnished only on condition that the user deposit with the Company an amount equal to the value of such arcs or incandescent lamps as are furnished by the Company. The value of the lamps not returned intact when such user discontinues the Company's service at that location, will be deducted from said deposit.

Incandescent.

Where a customer, whose contract entitles him to the Company's lamp service, requests the Company to furnish Mazda lamps of 100 to 500-watt sizes in exchange for lamps of less wattage, such lamps will be furnished subject to the rules of the Department of Gas and Electricity of the City of Chicago with regard to the number and wattage of lamps to be carried on the circuits.

Arc Lamps Inside.

Arc lamps installed inside of buildings must be supported by hanger boards supplied by the customer.

Inside lamps when hung from an ordinary ceiling covered with lath and plaster must be supported by a hook which is fastened into a wooden beam. When such lamps are hung from a ceiling in a fireproof constructed building, a block, about 12 inches long, 5 inches wide and ⅞ inch thick, must be installed, held by either two expansion bolts or four toggle bolts, depending upon the character of the ceiling. The bolts should be at least 4 inches long and 7/16-inch in diameter.

When lamps are supported by a gas pipe, an insulating joint necessarily must be provided to which is attached a hook for hanging the lamp.

Transformers used in connection with moving picture arcs or spot arcs must be wound for 230 volt service.

Inquiry should be made of the Inspection Bureau in all cases where more than five alternating current arc lamps are being wired as to whether incandescent and arc lamps may be wired on the same service mains.

Arc Lamps Outside.

Arc lamps installed outside of buildings must be provided with a suitable crane and a hook.

Outside lamps must be installed so that the bottom of the lamp will not be less than 8 feet above the ground. The length of such lamps is about 40 inches.

If it is necessary to install lamps beyond the reach of a 6 foot step ladder, some arrangement must be made for lowering the lamp so that it may be trimmed.

AUXILIARY OR BREAKDOWN SERVICE.

Where a customer is granted the privilege of using the Company's service as a reserve, auxiliary or breakdown service in connection with his usual source of supply, he must furnish and install a circuit breaker approved by the Company which shall be set to break the connection with the Company's service in case his maximum demand shall at any time materially exceed the number of kilowatts which the Company has agreed to supply.

The circuit breaker for Edison three-wire service shall consist of 2 single pole breakers equipped with a so-called gang attachment and connected so that one will be installed in each of the outer conductors of the circuit. In case of three phase service, a single pole circuit breaker with a gang attachment will be required in each of the three conductors. The circuit breaker must be installed in a sealed steel box provided by the customer, in a suitable location between the service switch and the Company's meter.

INSPECTION.

All wiring which is to be connected with the Company's service must be inspected and approved by the Department of Gas and Electricity of the City of Chicago, and must conform to the rules and regulations established by the Company from time to time.

A Temporary Current Permit, or Certificate of Installation, issued by the Department of Gas and Electricity of the City of Chicago must be presented at the office of the Inspection Bureau of the Company before the electricity can be turned on. This applies to additional wiring which may be connected at any time, as well as to original installations. The Company reserves the right to make final connection of all wiring to its mains and in case any damage results from unauthorized connections the customer will be held responsible for such damage.

Every electrical contractor is urged to stencil his name, address and telephone number on the service, cutout cabinet or meter board. This information will enable the Company to communicate promptly with the contractor when necessary.

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To Many Builders—and Some Architects

The strongest evidence that we can advance in support of our contention that every Building should be piped for gas during construction can be found in our records, showing that we are sooner or later called upon to furnish gas to occupants of most every building in the city.

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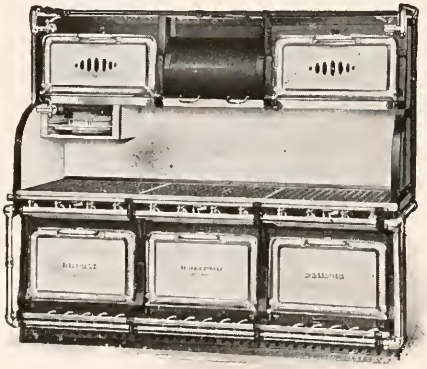

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GAS FITTERS' RULES

Of the Peoples Gas, Light and Coke Company.

OFFICE BUILDINGS, DWELLING HOUSES AND FLATS. MANUFACTURED GAS FOR LIGHT

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The following rules governing the piping of buildings for the distribution of gas for light and fuel have been adopted by The Peoples Gas Light and Coke Company.

General Instructions.

1. Inspection of Piping. Piping should be inspected by the Gas Company both after it is completed and before the interior of the building is lathed or covered. It must be inspected again after the building has been completed and before the fixtures are installed. Twenty-four hours' notice will be required for each inspection. Gas fitters must have the work completed and the piping tight before they notify the Gas Company to make these inspections.

2 Testing. Before fixtures are installed, the piping must stand a pressure of 6 inches on a column of mercury without showing any drop in the column for a period of ten minutes.

After fixtures are installed, piping must stand a pressure of one inch on a column of mercury without showing any drop for the same period of time.

3. Obstructions in Pipe. All piping must be free from burrs and other obstructions.

4. Defective Material. Split pipe or fittings repaired with cement or lead must not be used. Caulked fittings must not be used.

5. Material Not Allowed. Unions or bushings must not be used in work that is to be concealed, and cast iron fittings are prohibited in either exposed or concealed work.

6. Capping Outlets. All outlets must be securely closed with iron caps until fixtures or appliances are installed.

7. Piping on Outside Wall. When it is absolutely necessary to run pipe on an outside wall a furring strip must be placed between the pipe and the wall.

8. Piping on Masonry Walls. All piping run on masonry walls must be securely fastened thereto by strapping it to wooden plugs driven into the wall.

9. Imbedding in Concrete or Cement. When pipe is to be imbedded in concrete or cement, it must be covered with tar paper or other suitable covering, or laid in a conduit pipe.

10. Trapping Pipe. To avoid trapping pipe gas fitters must grade it to riser or to drops, except as provided in rule No. 66.

11. Breaking Sizes. In every case where an extension is to be made, pipe must be broken at a point where the full size can be maintained.

No extension must be made from a pipe of a smaller size.

12. Drops from Branch Lines. Drops on branch lines should have a set of 4 inches and they must be dropped square. Outlets for side brackets may be either square bends or long drop ells. The use of nipples is prohibited.

13. Compressed Air. Compressed air must not be used for industrial appliances.

14. Work Not Allowed. Gas fitters must not do any underground piping outside of a building.

15. Connecting Appliances. Fitters are particularly requested to see that all gas burning appliances are connected solid with iron pipe. Under no circumstances will this Company approve of the use of lead pipe or rubber tubing.

16. Typesetting Machines. A linotype or monotype machine must be supplied by a separate fuel run.

Rules and Tables for Piping.

17. Single Pipe System. The following tables and rules provide for a single pipe system in either new or old buildings. However, should it be more economical to install a double pipe system, such may be installed, and outlets computed on the same basis as that for a single pipe system.

18. Fuel Only. When piping is installed for illumination in either a new or old building, an outlet must be left for fuel.

If gas for light is not desired, a building may be piped for fuel only.

19 Understanding Rules. If, in any instance, the rules governing the sizes of pipe to be installed are not clearly understood, or if unusual conditions not covered by the rules are met with, the Gas Company should be consulted.

20. Size of Pipe Required and Equivalents. The amount of gas passing through a ⅜-inch pipe under normal pressure is approximately 10 cubic feet of gas an hour. The capacity of a ⅜-inch outlet has therefore been called an equivalent, and the table of pipe sizes below has been figured out on that capacity and is to be used in estimating the size of the pipe necessary to give an adequate supply of gas to an appliance.

For example, a range for a flat or residence requires five times the quantity of gas supplied by a ⅜-inch pipe, or five equivalents.

Range for flat or residence....	5	equivalents
Grate or log..................	3	"
Laundry appliance............	3	"
Water Heater	4	"
Arc Lamp	2	"

The number of ⅜-inch equivalents for any appliance not mentioned in the above table may be determined by dividing the total consumption per hour of that appliance by ten.

Consumption of gas-fired steam boilers may be obtained by assuming 80 cubic feet of gas per hour for each horsepower.

21. Size of Opening. To determine the size of the opening required when risers are connected at the meter end, the combined loads of the risers must be added together. (See table in Rule 23.)

22. Size of Riser for Combined Lines. When two or more lines of pipe are connected in order to be supplied by one riser, the riser must be of sufficient size to supply the combined load of all the lines. (See Rule 23.)

23. Office Buildings, Schools, Hospitals, Residences and Flats, Under Single Pipe System.

Size of Pipe in Inches	Feet of Pipe Allowed	Number of ⅜-inch Equivalents allowed
⅜	30	2
½	40	4
¾	60	10
1	70	15
1¼	100	30
1½	150	60
2	200	100
2½	250	200
3	300	300
4	450	500

Notes: Any ceiling 20 feet high or over must have ½-inch drops.

In a residence or a flat building, a ¾-inch outlet for a range in a kitchen may be used to supply two appliances, such as a range with a ¾-inch outlet extended full size, and a water heater or a laundry appliance with a ½-inch extension.

24. Stores and Factories.

Size of Pipe Inches	Feet of Pipe Allowed	Number of ½-inch Outlets allowed
½	30	1
¾	60	8
1	70	12
1¼	100	20
1½	150	35
2	200	50

Notes: For stores the running line must not be less than ¾-inch to the last outlet.

Drop outlets for stores must be ½-inch in size.

25. Bracket and Window Lights. Thirty feet of ⅜-inch pipe will be allowed for bracket lights. The same length of ½-inch pipe will be allowed for window lights.

26. Piping Rooms in Rear of Store. When a store building with living rooms in the rear is supplied by one riser, the running line must be ¾-inch to the outlet for fuel.

27. Domestic and Industrial Appliances. Gas to be used at one point.

Size of Pipe in Inches	Feet of Pipe Allowed	Number of ⅜-inch Equivalents allowed
½	80	4
¾	90	10
1	100	20
1¼	150	30
1½	200	40
2	250	60

28. Automatic Water Heaters. An automatic water heater must be supplied with a separate pipe. For sizes and lengths allowed see table under this rule.

Pipe run to supply any automatic water heater, not shown in the following table, must be one size larger than the opening of the appliance. The length allowed may be ascertained from table in Rule 27.

Humphrey Heater	Pittsburg Heater	Ruud Heater	Size of Pipe in Inches	Feet of Pipe Allowed
20.....	...	1½	1	100
30.....	...	...	1	100
2A to 2C....	2	...	1	100
		2½	1	100
3A to C.....	3	3	1	100
4A to C.....	4	4	1¼	150
6A to C.....	6	6	1½	200
8A to C.....	8	8	2	250

29 Gas Engine. The gas supply for a gas engine must be separate. An independent service will be required, and a governing holder or other similar device acceptable to the Company must be used. Before any work of installing a gas engine or piping for one is done, consultation with the Gas Company is advised.

Horse-power	Size of Pipe in Inches	Feet of Pipe Allowed
1 to 7.....	1	100
8 to 12.....	1¼	100
13 to 22.....	1½	100
23 to 35.....	2	100
36 to 50.....	2½	100
51 to 100.....	3	100
101 to 150.....	4	200

Note: If the length of pipe required exceeds the number of feet allowed, the allowable length may be doubled by increasing the pipe one size.

30. Building Services.

Size of Pipe in Inches	Feet of Pipe Allowed	Number of ⅜-inch Equivalents allowed
1	70	16
1¼	100	40
1½	150	86
2	206	120
2½	250	200
3	300	300
4	450	500

Note: All openings in a building service must be of the same size as that of the riser which in no case must be less than ¾ inch in size.

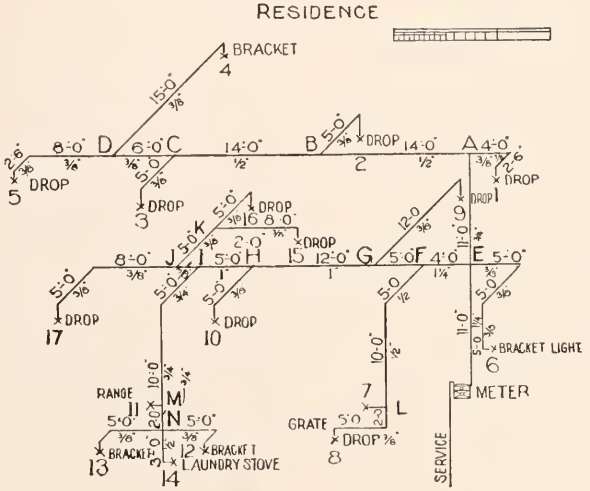
31. Plans of Piping and Their Explanation.

In determining sizes of piping for a building the starting point must be the extreme end of the system and all calculations must be made from there on to the meter.

Plan No. 1. Residence.

Line	Number of ⅜-inch Equivalents supplied by line	Length	Size
5 to D	1	10′ 6″	⅜″
4 to D	1	15′	⅜″
D to C	2	6′	⅜″
C to 3	1	5′	⅜″
C to B	3	14′	½″
2 to B	1	5′	⅜″
B to A	4	14′	½″
1 to A	1	6′ 6″	⅜″
A to E	5	11′	¾″
J to 17	1	13′	⅜″
K to 16	1	5′	⅜″
K to 15	1	8′	⅜″
K to J	2	5′	⅜″
J to I	3	2′	½″
N to 14	3	3′	½″
N to 13	1	5′	⅜″
N to 12	1	5′	⅜″
N to M	5	2′	¾″
I to M	10	15′	¾″
I to H	13	5′	1″
H to 10	1	5′	⅜″
H to G	14	12′	1″
9 to G	1	12′	⅜″
G to F	15	5′	1″
8 to L	1	7′	⅜″
L to F	4	15′	½″
E to F	19	4′	1¼″
6 to E	1	15′	⅜″
E meter	25	11′	1¼″

SAMPLE PIPING PLAN
RESIDENCE



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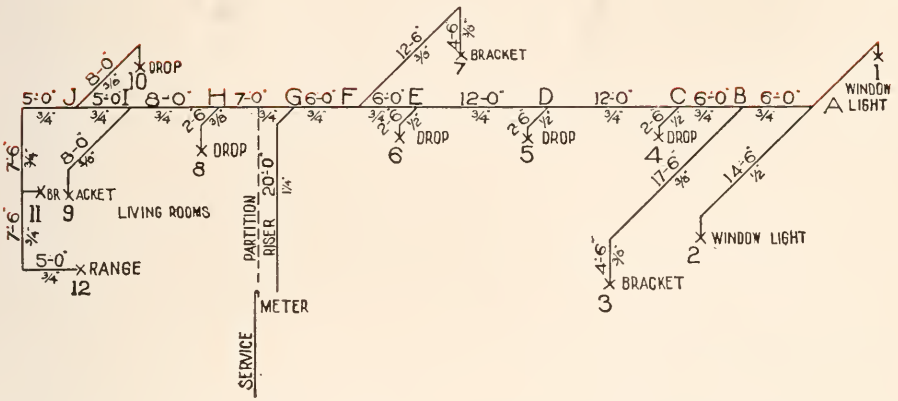
SAMPLE PIPING PLAN

STORE WITH LIVING ROOMS IN REAR



Plan No. 2. Store with Living Room in Rear.

Line	Number of ⅝-inch Equivalents supplied by line	Length	Size
K to 12	5	12′ 6″	¾″
K to J	6	12′ 6″	¾″
10 to J	1	8′	⅜″
J to 1	7	5′	¾″
9 to I	1	8′	⅜″
I to H	8	8′	¾″
8 to H	1	2′ 6″	⅜″
H to G	9	7′	¾″
2 to A	2	14′ 6″	½″
1 to A	2	9′ 6″	½″
A to B	4	6′	¾″
3 to B	1	12′	⅜″
C to B	5	6′	¾″
4 to C	1	2′ 6″	⅜″
C to D	6	12′	¾″
5 to D	1	2′ 6″	⅜″
D to E	7	12′	¾″
6 to E	1	2′ 6″	⅜″
E to F	8	6′	¾″
7 to F	1	17′	⅜″
G to F	12	6′	¾″
G meter	21	20′	1¼″

METER AND RISERS AND THEIR LOCATION.

32. Location for Meter. The Company reserves the right to determine in all cases the location for the meter.

33. Location for Risers. All risers must be placed in public basements, provided the latter are dry and warm and not less than 6 feet in height. The Gas Company positively will not set a meter in a basement that is less than this height.

If no public basement or meter room is provided, the riser for each floor should be placed either in the toilet, pantry or kitchen of that floor.

34. Risers in Laundries, etc. Risers may be run to laundries, furnace or boiler rooms, provided the risers are not placed closer than 10 feet to any appliance and in no case directly in front of a boiler or a furnace.

35 Riser for Theatre. A meter to supply a theatre may be set in a public meter room with other meters and may be supplied by the service supplying these meters.

36. Piping for Laundry Room. In a flat building where appliances, such as laundry stoves, driers, etc., are installed for the joint use of tenants, a pipe from each tenant's meter must be run to the laundry room and a header provided on the wall adjacent to the appliance. Each riser must be equipped with a lock-cock.

A meter tag with the flat number plainly marked thereon must be securely fastened to each cock.

One outlet for a light in the laundry may be taken from the end of the laundry header.

37. Riser in Cold Basement. A riser in an unheated basement should be located 4 feet from an outside wall. If, however, the owner desires the meter set on the outside wall, this will be permissible, provided a false partition of wood is built and an air space of 2 inches is left between the partition and the wall.

38. Vestibule Partition A riser must not be run closer than one foot to a vestibule partition.

39. Electric Cut-off Box. A riser must never be brought to a point nearer than 5 feet from an electric cut-off box.

40. Riser in Other Apartment. A riser for one apartment must not end in another apartment, except as provided for in Rule No. 48.

41. Prohibited Locations for Risers. A riser must not end in any place where the Gas Company's meter will be exposed to frost or dampness, or liable to injury from any cause.

LOCATIONS SPECIFICALLY PROHIBITED.

Under a bulkhead or show-window.

Horse stall or any place in a barn where it would be at all liable to be disturbed by horses.

Sleeping apartment.

Stairway closet.

Bedroom closet.

Under a sink or washstand

Over a toilet stool.

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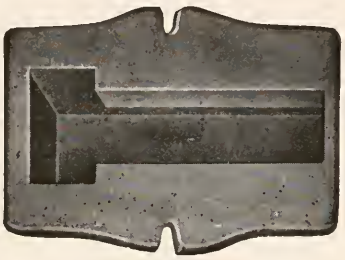

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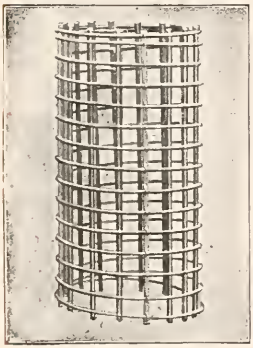

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In the way of a flush tank.

Over a gas or an electric light.

In a closet that is not properly ventilated by means of either a register or an opening close to the ceiling.

In a room where a moving picture machine is to be operated.

42. Riser in Front Hall. If the riser in an old building must end in the front hall, the pipe must not be run to a point nearer than 4 feet from the outside wall.

43 Height of Risers. A riser must be placed at a height of not less than:

4 feet from the floor for openings up to 60 in number.

5 feet from the floor for 60 to 100 openings.

6 feet from the floor for any number over 100 openings.

No riser must be placed higher than 9 feet from the floor.

44. Distance Below Ceiling. A riser must extend not less than 1½ inches below a finished ceiling, or 2 inches below an unfinished one.

45. Exit Lights. When running pipe for exit lights in theatres, schools, amusement or assembly halls, the city building ordinance should be referred to.

46. Light for the Top Floor. The top floor of a single building is considered a private hall, and, if desired, a light may be taken from the running line supplying that floor.

47. Public Lights—3-Flat Building. In a three-flat building or over, outlets for vestibule, public hall and basement lights must be taken from an independent pipe, and an opening left on the building service so that a separate meter can be set for these lights. If so desired, the riser may be connected with a union, or a right and left coupling to the meter of the applicant who may wish to pay for the gas.

48. Public Lights—2-Flat Building. In a two-flat building the outlets for the vestibule and basement lights must be taken from a separate riser, the end of which must be located near the first floor riser so that these outlets can be connected. A separate outlet in the building service for the vestibule and basement lights will not be required.

OUTLETS.

49. Outlet for Fuel. If the pipe has been run under the floor, the outlet for fuel in a kitchen must be left 3 inches above the floor and 2 inches clear of the baseboard. If the pipe has been run overhead and down, the outlet must be left 3 feet from the floor and 2 inches clear of the finished wall.

50. Drops. Drop outlets in a residence must be produced 1½ inches below an unfinished ceiling, or ⅝ inch below a finished one. In a store the drop outlets must be produced 2¼ inches below an unfinished ceiling, and 1½ inches below a finished one.

51. Mantel or Fireplace. An outlet for a mantel or fireplace must be produced ½ inch above the finished bottom of the fireplace, 6 inches from the left hand side and 6 inches from the back.

BUILDING SERVICES.

52. Building Service Only. If it is desired to install a building service only in any building, instructions for size of pipe and openings to be left must be obtained from the General Office of the Gas Company.

The size of the building service must in every case be determined by the size and number of openings.

53. Building Service in Flat or Residence. A building service for a flat building, or a residence must be run overhead, and brought down in an inside partition, not less than 4 feet from an outside wall.

No building service must be run under a basement floor or under a first floor where there is no basement.

54. Building Service in Store. A building service in a store may be run overhead if the entire horizontal run of pipe can be graded to the street service. If not, it must be run under the floor.

When a building service is run overhead it must be brought down at least 4 feet from the front wall of the building.

55. Building Service Underground. When it is necessary to extend a building service underground from the front to the rear of a store or factory building, it must be encased in tile pipe with cemented joints.

56. Two Services in One Trench—Doorways. Where stores in one building are to be supplied with separate services, the building services for the adjoining stores must be brought as close together as possible. If two building services are within 4 feet of each other, the two street services will be run in one trench; if they are farther apart, two street openings will be required.

Building services may be run so that street service will come under doorway, provided the Gas Company is notified so that the service may be run before any mosaic, concrete or other floor is laid.

57. Building Service in Unheated Basement. A building service in an unheated basement must be graded to the street, and the tee left turned up so that any condensation forming in the pipe will run to the street and not to the meter.

58. Solid Wall Porch. In a building with a solid wall porch, the building service must be run to the front and then to the side wall.

59. Service Beyond Front Wall of Building. When there are one or more finished rooms in the front part of a basement and the owner does not wish to have the building service appear in these rooms, it may be terminated outside of them, but as close to the front of the building as the finished portion of the basement will permit.

The Company's service will be continued on the outside of the building to this point, provided it is not more than 50 feet from the lot line and provided that the pipe does not have to be laid in a space which is covered or to be immediately covered with cement.

60. Location of Building Service. When risers are located in the rear of a basement or in a room provided for that purpose, or on the various floors, the building service must be brought to within 18 inches of the wall through which the street service will be produced.

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61. Wrapping Building Service. A building service run under an open porch and connecting the front and rear sections of a building, must be covered with mineral wool or steam pipe covering and boxed in.

62. Encasing Building Service. A building service laid through a masonry wall must be encased and the pipe left resting on the bottom of the casing with a 1½-inch clearance on top.

63. Opening in Building Service. The opening in a building service should always be on the left hand side of the riser which it is to supply, and 15 inches from it.

64. Test-pipe to Prove Work. Every building service must have a ⅜-inch test-pipe to which a gauge can be attached.

65. Building Service Header. When it is necessary to set more than two meters together, a building service header must be supplied with an opening for each meter.

66. Services for Stores. A building containing stores must have a separate service for each store, unless a public meter room or other public place on the floor or below that where the gas is to be used is provided.

67. Services for Apartment Buildings. In apartment buildings of 12 flats and under, only one Company's service will be required. This will make it necessary to connect the various building services supplying the groups of risers regardless of fire walls, and extend one building service to the point where the Company's service will come in.

In apartment buildings containing more than 12 flats, two or more Company's services will be allowed.

68. Services for Court Buildings. In a building which faces on a park-way or has a park-way or court in the center, the Gas Company will run one service in the court or park-way, and branch therefrom to supply the various building services.

The gas fitter may run building services through fire walls and connect them, but these must be extended as close to the front of the building as possible.

Any building service in a court building must not be terminated in a finished room.

69. Locating Service to Corner Building. To avoid complications when working on a corner building, the gas fitter should obtain from the Gas Company a written notice giving the exact location where the Company's service will enter the building.

70. Building in Rear of Corner Lot. A building on the rear of a corner lot must be supplied from the side street if a gas main is on that street. If not, it may be supplied either from the front building or directly from the main, whichever is the more practicable.

71. Building in Rear of Lot. When a building in the rear of a lot is to be supplied, a separate service should be used wherever possible. If, however, an independent supply is not practicable, the building service for the front building, if there is one, must be extended to the rear of the building, and of a size not less than 1½ inches so the rear building can be supplied from it also.

In all cases where a supply to a rear building is desired the Gas Company must be consulted.

72. Opening in Wall for Service. In a new building, an opening should be provided in the wall for the Gas Company's service. The most preferable way is to build a sleeve of wood, rectangular in shape, 12 inches by 5 inches, with an inside partition about 6 inches from the street end of the sleeve.

Application should be made to the General Office of the Gas Company to locate the wall and the point in the wall wherein the sleeve should be built, so that when the service pipe is run, it will pass through the opening, provided therefor. In this way the damaging of foundation walls will be avoided.

73. Opening in Floor for Service When a service connection may have to be made above the floor level, an opening must be left in the floor so that the street service can be introduced without disturbing anything. The Building Inspection department will, on notification, instruct the gas fitter where to leave this opening.

74. Bringing Building Service to Street Service. When the Company's service is into a building before the house-piping is completed, the building service must be brought directly over the street service, except where the Company service comes through the bay, then the building service must be brought to the nearest corner of the bay.

75. Terminating Building Service. A building service must not be terminated in a coal hole or in any other place where it will not be easily accessible.

WORK DONE BY THE GAS COMPANY.

76. Work Reserved. This Company does not permit anyone but its own authorized employes to place any piping or connections on any part of either the outlet or inlet meter connections, turn on the gas, disconnect, move, or interfere in any way with its piping, meters or connections.

77. Instructions. If a meter is connected and the customer desires alterations in the house-piping which would necessitate the disconnecting and reconnecting of the meter, or service, or both, he should be directed to telephone to the General Office of the Gas Company, 128 S. Michigan Blvd.

78. Changing Location of Meter. If a customer wishes to have the location of the meter changed and will have the necessary piping installed, the Gas Company will reset the meter and reconnect the service without charge.

79. Work Done Free of Charge. If alterations in house-piping caused by the remodeling of building mean an increase in the consumption of gas, the Gas Company will change the location of the service or reconnect, free of charge, but under the service rules for paying, excess pipe, etc.

Increase of consumption must be indicated by the need of a meter of a larger capacity or an increase in the number of meters.

80. Work Charged For. If alterations in house-piping due to remodeling in building do not mean an increase of consumption the cost of changing the location of or reconnecting the service must be paid for by the customer.

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SPECIFICATIONS FOR STANDARD HOLLOW TILE FIREPROOFING

General: The Contractor for this work will be required to furnish all of the material and labor of every description required to erect the same in place complete. The Contractor is referred to the plans and details for the general construction, and especially the steel diagrams and details showing connection between the structural steel and tile work.

Special Shapes: The Contractor shall furnish all necessary special shapes for the proper fitting to the steel work.

Details: When requested to do so the Contractor shall furnish large scale details or full sized drawings for all special shapes, column coverings, lintel covers, girder covers, and general type of arch, which shall be submitted to the Architects for their approval.

Scaffolding, Tools, etc.: Furnish all the tools, machinery, hoisting apparatus and centering necessary to carry on the work at the rate of progress stipulated in the contract.

Tile: All the tile required for this work shall be of the best quality of hard burned fire clay, semi-porous, or porous terra cotta. This tile to be well manufactured, no badly split, cracked or warped tile will be permitted to go into the work.

Mortar and Laying: All tile work shall be laid in mortar composed of one part Portland Cement of an approved brand and four parts clean sharp sand, thoroughly mixed together dry and sufficient water added to wet to the proper consistency and then tempered with lime putty to make it work smooth. No more mortar shall be mixed at one time than can be used immediately. All tile must be laid with full flush joints, plumb to a line with horizontal beds uniformly level on each course. Fill all the joints, clinks and crevices between the tile and steel work with mortar well slushed in.

Type of Arch: The arches for the floors in general shall be — inch; flat or segment arches, with side or end construction. Skewbacks carefully bedded in place against beams.

Beam Tile: The soffits of all beams to be protected with slabs of tile at least 2 inches in thickness, with an air space at least ¾ of an inch by the width of the metal surface to be covered.

Roofs: The arches for the main roof are to be ———— in segment or flat arches same as specified for the floors.

Minor Roofs: The roofs of pent houses, roof over projecting portion in second story, floor of bulkheads, and other portions indicated on details as book-tile shall be made of Three-inch book-tile set in place between tee irons. Tee irons to be furnished by the Iron Contractor.

Partitions: All partitions shown on plans to be built of the thickness indicated in figures. Partition walls to be built straight, true, plumb and well bonded with proper "breakjoint" bond on each alternate course and all joints thoroughly flushed up with mortar, and to be well wedged underneath.

Hollow tile used for building primary bearing walls, which are defined as walls that may be used to receive directly the loads from floors or roofs in addition to their acting as bearing partitions, must have a thickness of at least one-fifteenth the free height between floors and the load including the weight of the construction must not exceed 350 lbs. per sq. in. of net sectional area of the tile in compression.

Furring Tile: Where indicated on plans, 2 inch furring tile are to be built against the outside walls of the building. These tiles are to be secured to the brick walls with 10d spikes on every third course, driven into the brickwork at intervals not greater than 48 inches apart.

Curb Walls: The curb walls in basement shall be furred with three inch tile extending up to the under side of the iron plate along edge of curb walls and properly fitting around all beams.

Rough Frames and Blocks: The Contractor for carpenter work will furnish and erect the rough wood frames at all openings in partitions and furring. He will also furnish all wooden blocks necessary to form nailing facilities for attaching plaster grounds, etc. These blocks must be built in place by fireproofing contractor wherever directed by the Architect.

Column Covering: All column covering shall start in all cases, directly from the tile arches of floor, column covering shall be designed to properly fit the columns and shall be secured by winding No. 12 gauge galvanized wire around the columns after the tile has been set around such columns The wire shall be wound around the tile in such a manner that every tile is crossed at least once by a wire.

Covering Exposed Steel Work: All girders, beams, channels, etc., that show below the under side of ceilings, are to be encased on all sides with at least 2 inches thickness of fireproofing tile, so applied as to be supported entirely by the girders or beams protected.

Boxes for Plumbing Pipes: All soil, vent, down spout and water supply pipes shall be boxed in, using three inch tile, starting from the floor tile in all cases. This boxing shall not be done until the pipes have been properly tested, and covered by another contractor. There shall be no openings into boxes except for outlets on the various floors. Where these outlets occur small wood frames furnished by carpenter shall be set by the fireproofing contractor.

Bulkheads: All bulkheads of first and second floors shall be built of three inch tile, the structural iron contractor furnishing all necessary tee irons for the support of the tile. See details for bulkhead treatment, and iron drawings for the support.

Provide three inch tile for the ends of bulkheads where intersected by the entrance doors.

Toilet Room Floors: All toilet room floors where shown on plans shall be raised approximately one foot with fireproofing, supports to be so arranged as not to interfere with the piping of these rooms.

Pent Houses: The contractor shall build the walls of pent houses with four inch hard or glazed tile, laid up in Portland cement mortar, all joints to be thoroughly flushed up.

Curbs of all skylights shall be built of four inch tile.

Floor Strips and Concrete Filling: After the floor arches have been set in place, and at such time as may be designated by the architect, the contractor for carpenter's work will furnish and set the 2x3 inch wood floor strips required as nailing ground for the finished wood flooring, where wooden flooring is called for.

After the strips have been set, the fireproofing contractor must fill in between the same with concrete filling; this concrete is to be composed of one part American Portland cement, of approved brand, two parts sharp sand, and six parts broken tile, stone, gravel, or fine, clean coal cinders, thoroughly

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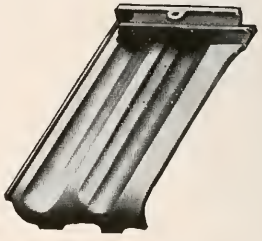

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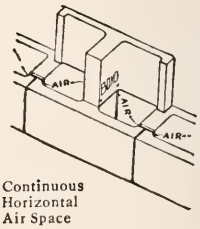

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mixed together dry, then tempered and mixed and tamped in place. In no case shall cinder concrete be allowed to come in contact with structural steel.

Tile Blocking and Filling Between Floor Strips: For all wood floors on top of tile arch construction throughout the building lay on top of the tile arches, lines of tile of special die to receive the wood floor strips. The tile shall have a width on top equal to the width of the floor strip at the bottom and shall be leveled on both sides in continuation of the level of the wood strips. After the wood strips are in place the spaces between them shall be filled with 2" special tile formed so as to firmly wedge them in place, the upper surface of the tile being ¼ of an inch below top of sleepers, all in accordance with detail.

Finally: Do everything necessary to finish the entire work in a thorough and substantial manner in strict accord with building laws and ordinances locally applicable. Remove promptly from the premises all the tools, scaffolding, unused tile, debris, etc., as soon as each portion is completed, so as to maintain all portions of the premises as free from obstruction as practicable.

RULES OF MEASUREMENT FOR EXCAVATION AND CONCRETE WORK.

The following rules have been carefully studied and analyzed by a joint committee consisting of five (5) members of the Chicago Architects Business Association, five (5) members of the Western Society of Engineers, and five (5) members of the Contractors' and Masons' Association of Chicago.

If any new rules or new applications of old rules should be found in the following, we can only say for their recommendation that we have carefully considered them in all their bearings, endeavoring to secure equal justice to owner as well as contractor, and that they will form the standard for deductions as well as for compensation for extra work.

EXCAVATION OF CELLARS AND BASEMENTS.

1. Excavation to be measured and computed by the actual amount of material displaced. If unit price is based upon loose measurement add forty (40%) per cent to actual bank measurement, except if consisting of sand and gravel, when only twenty (20%) per cent will be added. If rehandling becomes necessary, same to be done at a special price agreed upon in addition to the above.

EXCAVATION OF TRENCHES AND PITS.

2. Excavation of trenches, pier holes, or pits when more than 3′ wide to be computed on actual contents when less than five (5′) ft. deep.

When less than three feet wide excavation of trenches, pier holes, or pits to be computed on actual contents if less than two (2′) feet deep.

If more than two feet (2′) deep compute contents of trench on base of three foot (3′) width, even though same is narrower.

If less than two (2′) feet in depth estimate actual width.

For pits or pier holes more than two (2′) feet deep and less than twelve (12) square feet in area estimate area of same on base of twelve (12) square feet multiplied by depth of same down to five (5′) foot, and if more than five (5′) feet deep estimate on same basis as given below for additional depth of trenches, with the same percentages of increases added.

Add 75% to actual contents of excavation of trenches, pier holes, or pits for depth between five (5′) ft. to ten (10′) ft.

Add 150% to actual contents of excavation of trenches, pier-holes, or pits, for depth between ten (10′) ft. and fifteen (15′) feet.

Add 225% to actual contents of excavation of trenches, pier holes, or pits for depth between fifteen (15′) feet and twenty(20′) feet.

Add 300% to actual contents of excavation of trenches, pier holes, or pits for depth between twenty (20′) feet and twenty-five (25′) feet.

Add 375% to actual contents of excavation of trenches, pier holes, or pits between twenty-five (25′) feet and thirty (30′) feet in depth.

Add 450% to actual contents of excavation of trenches, pier holes, or pits between thirty (30′) feet and thirty-five (35′) feet in depth, and so on, adding 75% accumulative for every five (5′) feet additional depth.

BACK FILLING AND GRADING.

3. Soil required for back filling or grading to be measured by computing from cross-sectioning cubic contents of area to be filled or graded.

SHEET PILING.

4. Sheet piling and lagging to be estimated per thousand feet of lumber required. Kind of lumber to be specified.

SHORING OF EARTH BANKS.

5. Shoring of earth banks to be done at unit price, per square foot of shored surface of bank.

DRAINING.

6. Pumping or bailing when required to be done at special price, in addition to excavation unit price, as the excavation rules are based on dry work: this, however, does not apply to rain or storm water.

CONCRETE FOUNDATIONS.

7. Foundations for walls to be measured actual contents when made with square and level off-sets.

Footings with sloping or beveled off-sets less than 30% from the horizontal multiply area of base by greatest height of footing. This applies to piers also, except when courses in pier foundations are less than twelve (12′) feet in area, when one (1) cubic foot will be added for each corner for every foot in height of such course.

8. Foundations for all projections such as chimney breasts, pilasters, buttresses, or flues connected with walls to be measured actual contents contained therein, and one cubic foot added thereto for each corner for every foot in height.

9. Recesses and slots in foundations to be measured solid and in addition thereto allow two (2) cubic feet for every foot in height or length.

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10. Arches in foundation. Multiply length of chord at spring of arch by height from chord to extrados by thickness of arch, and add to the wall measurement. Height of arching equal to thickness of wall.

CIRCULAR OR POLYGON FOUNDATIONS.

11. Circular or polygon foundations to be figured at double actual contents.

EXTERNAL, DIVISION AND INTERIOR CONCRETE WALLS.

12. For walls fourteen (14) feet or less in height, twenty-four (24) inches or more in thickness, use the actual thickness as basis in computing the volume. For walls less than twenty-four (24) inches in thickness, add one-half the difference between the actual thickness and twenty-four (24) inches in computing the volume. If walls are more than fourteen (14) feet in height between floors add to cubic contents fifteen (15) per cent for every additional four (4) feet in height, on accumulative scale, as given for trench excavation.

CIRCULAR WALLS.

13. For circular walls of radius sufficiently large to obviate the necessity of using specially prepared lumber for forms, add one-fifth (1-5) of length to girt of wall, and figure cubic contents on the same basis as prescribed for External and Division Walls, Paragraph 12.

BATTERED WALLS.

14. For battered, or sloping walls estimate contents on same basis as for external and division walls, and add one-half (½) of contents of wedge, or batter to same when narrower on top than twenty-four (24") inches. See Paragraphs 12 and 17.

INTERSECTION OF WALLS.

Intersection of division walls twenty-four (24) inches thick or less (bonded together in any manner not abutting) to be measured as slot or recess. When thicker add (1) one foot to length of wall for every intersection when measuring.

RETAINING WALLS.

15. In retaining walls reinforced with beams, columns, or girders figure concrete casing a minimum thickness of twelve (12") inches from outside edge of steel on side next to earth bank and six (6") inches from outside edge of steel on opposite side—i. e. compute wall one foot, six inches (1'-6") thicker than width of steel.

For all other retaining walls compute on same basis as for external or internal walls, paragraphs twelve (12) and seventeen (17.)

No deduction in cubic contents of concrete to be made for metal imbedded in same.

HOLLOW WALLS.

16. Hollow walls to be at special rates.

CORNERS.

17. For each corner of wall more or less than ninety (90) degrees add one foot, six inches (1'-6") to girt length of walls in measuring.

The term corner is used for salient angles of walls, and angle for re-entering angles.

PILASTERS, ETC.

18. All plain projections, such as chimney breasts, piers connected with walls and pilasters to be measured actual contents contained therein, and one (1) cubic foot added for each corner for every foot in height.

PIERS.

19. Independent plain square piers to be measured by the same rule, i. e. add one cubic foot for each corner for every foot in height. For plain polygon or round piers, add four (4) cubic feet for each foot in height.

RECESSES.

20. Recesses and slots to be measured solid and in addition thereto allow two (2) cubic feet for every foot in height or length.

ARCHES.

21. In Vaults: multiply length of chord at spring of arch by height from chord to extrados by thickness of arch.

In walls: find contents of arch by same rule and add same to wall measurement, as called for in paragraph ten (10).

In sewers and tunnel arches: multiply length of extrados by thickness of arch.

OPENINGS WITH FRAMES BUILT IN.

22. Deduct contents of windows, doors and other openings, measuring from jamb to jamb and from top of sill to spring of arch, and add two (2) feet of wall for each jamb for every foot in height of opening when plank frames are used; if box frames are used add four (4) feet of wall for each jamb for every foot in height.

OPENINGS WITHOUT FRAMES.

23. Deduct contents of openings, same to be measured from top of sill to spring of arch and shortest distance between concrete jambs for width, and add for each jamb two (2) feet of wall for every foot in height of opening.

Circular, oval or other special shaped openings to be figured at special price.

CHIMNEY BREASTS, FLUES AND PILASTERS.

24. All flues and hollows in chimneys or walls less than two (2) feet in area, figure solid and add two (2) cubic feet for every foot in height. All flues and hollows in chimneys or walls from two (2) feet to four (4) feet in area to be measured solid. When larger, deduct one-half (½) of contents of flue.

Detached portions of chimneys in buildings and plain chimney tops above roof to be measured solid, and one (1) cubic foot to be added for each corner for every foot in height.

DETACHED STACKS.

25. Detached chimney stacks to be figured at special rates.

TRIMMINGS.

26. No deductions allowed for omissions of concrete for cut-stone, terra cotta or other trimmings, bond blocks, timber, joists or lintels.

All ornamental or moulded work in cornices, gutters, belt or sill courses, etc., to be figured at special rates.

CUTTING AND PATCHING.

27. Cutting and patching of joists, girders, or other holes, slots, panels, recesses, etc., to be paid for on basis of time and material required.

TOOTHING.

28. When ordered by the Owner, Architect, Engineer, or the Superintendent in charge of the work, to rack or block in consequence of delay of delivery of iron, steel, stone, terra cotta, or other material, that concrete work may connect with such rack-

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ing or blocking shall be measured as extra work, as follows: Increase girt length of such line by one-half (½) and multiply by thickness of wall.

CONCRETE FLOORS ON SOIL AND TILE ARCHES.

29. Floors to be measured by the superficial surface between outside walls of building. No deduction to be made for floor sleepers, conduits, pipes, drains, division or partition walls. No deduction to be made for any piers, columns, chimney breasts, pilasters or other projections of walls of ten (10′) feet or less in area.

CAISSONS.

30. Owing to grillage in caissons being left at different heights in same building, unit price for caissons will be computed on excavated contents, including necessary wood-lagging and rings for same. Cubic contents of excavation of caissons to be computed from top of first set of lagging to bottom of caissons and from outside to outside of lagging. If steel or other special casing is required same to be paid for additional, at special unit price per pound.

BELLS.

31. Area of bottom of bell to be multiplied by height of bell to neck for cubic contents.

32. For Caissons 7′ 0″ or more in diameter estimate actual contents from outside to outside of lagging.

For Caissons from seven to six ft. six inches inclusive add 5% to actual contents.

For Caissons under six feet six inches to six feet inclusive, add 15% to actual contents.

For Caissons under six feet to five feet six inches inclusive, add 25% to actual contents.

For Caissons under five feet six inches to five feet inclusive, add 35% to actual contents.

For Caissons under five feet add fifty per cent (50%) to actual contents.

33a. If compressed air is required, same to be paid for in addition to the above.

33. If rings are ordered left in caissons, same to be paid for additional at unit price per pound.

34. Pumping and bulkheading to be paid for at additional price.

35. No deduction to be made for cubic contents of metal imbedded in concrete.

CONCRETE FILLING IN CAISSONS.

36. Concrete for filling of caissons to be computed on actual contents per cubic foot of concrete, but no deduction to be made for any metal imbedded in same.

REINFORCED CONCRETE WORK.

37. Reinforced Walls:

Compute concrete on same basis as specified in Sections 12 and 17, for external and division walls, and add to same cost of reinforcing metal put in place. If through changes or revisions cutting of reinforcing metal delivered or ordered becomes necessary, estimate the full length of such bars or metal fabric, and add to same cost of cutting and fitting required. Reinforcing metal to be computed on unit price per pound or square foot. No deductions to be made in estimating cubic contents of concrete for any metal imbedded in same, such as wire netting, expanded metal, bars, beams, columns, etc.

COLUMNS.

38. Measuring of plain uniform size columns to be covered by the foregoing paragraph 19 relating to piers.

39. Capitals, caps, brackets, panels, mouldings or other ornamental or moulded work to be figured special rate.

GIRDERS, FLOOR BEAMS OR OTHER DROP PROJECTIONS BELOW FLOOR SLAB.

40. For projections named in this paragraph add for each corner and angle to cubic contents one (1) cubic foot for each foot in length. For each chamfered or rounded corner or angle add one-half (½) cubic foot for each foot in length in addition to the above.

FLOOR SLABS.

41. Floor and roof slabs to be estimated on same basis as called for in paragraph 29 for floors on soil, and at a minimum thickness of six (6) inches. Less than six (6) inches in thickness will be computed as six (6) inches

OPENINGS.

42. No deductions to be made in floor area for openings of less than twenty (20) square feet. For larger openings after deducting full area of opening, add one (1) superficial foot to floor area for each foot in length of girt of opening, and one (1) CUBIC FOOT extra for each corner or angle.

DEPRESSIONS.

43. For pits, baskets or other depressions in floor, add on superficial foot to the area of walls and floor of same for each foot in length of each corner and angle.

SETTING OF FACIAS, FRAMES, PIPES, SLEEVES, BOLTS, RODS, CLAMPS, ETC.

44. Setting of facias, frames, pipes, sleeves, bolts, rods, clamps, etc., imbedded in concrete to be paid for additional at special price.

FLOOR BASE AND COVES.

45. Floor base and coves to be estimated at special price per lineal ft. with one foot added to length of same for each corner and angle. For base or cove around round columns estimate three (3) times girt of column and for square or polygon columns add one foot for each corner to girt of same.

46. Concrete stairs to be estimated square foot area of face of treads and risers. Stair-landings and platforms between floors to be same unit price per foot as stairs.

47. Curbs and roofs or skylights to be estimated on same basis as called for in sections 40 and 41 except that quantities for same shall be doubled.

48. Sidewalks laid on soil or tile and brick arches, to be estimated as floor-slab section 29 with special unit price.

Sidewalks reinforced to be estimated same as called for in sections 40 and 41 with special unit price.

Curbs to be estimated per lineal foot at special unit price.

Driveways to be estimated square foot area at special unit price. (Signed)

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Thomas H. Mullay, B. E. Grant,
Joseph C. Lewellyn, A. Lanquist,
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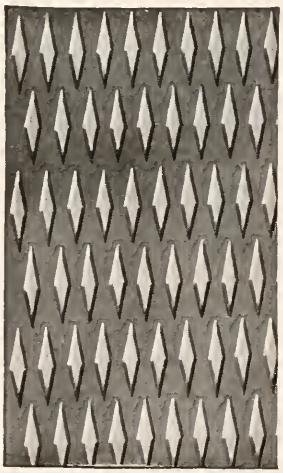

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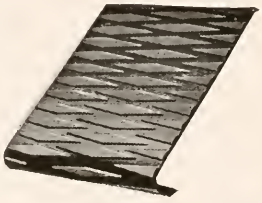

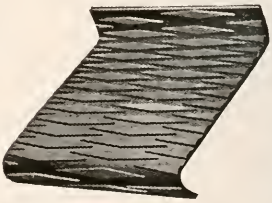

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DEVELOPMENT AND PROGRESS IN THE MANUFACTURE AND USES OF STRUCTURAL STEEL AND THE SPECIFICATIONS THEREFOR

By ROBT. W. HUNT & CO.

It was somewhere in the closing years of the nineteenth century that this country was awakened to the greater possibilities and wider field of usefulness and operation offered by the use of structural steel in building construction. While the laymen or average business man looked with amazement at the tall buildings and huge bridges being erected in and about all of our large cities in the surrounding country, he doubtless has no conception of what tremendous strides have been made during the last two or three decades in the development and economical manufacture of structural steel which has made the erection of these large structures possible.

One need not look back more than twenty-five years to the time when a steel skeleton building, fifteen stories high, was considered a wonder, and a building forty stories or more, such as the Singer Building, the Woolworth Building, the Equitable Building and the Metropolitan Life Building in New York City would have been considered impossible. Today this type of steel skeleton building is universally regarded as the standard form of construction of office buildings. However, the use of structural steel is not confined to tall buildings and bridges, but is now very extensively used in the erection of many different kinds of structures, such as dams, coal tipples, water tanks, towers, piling, transmission line poles, railway cars, ships, barges and various other forms of construction which consume a very large proportion of structural shapes turned out in this country.

The first 15-inch I-beams made here were rolled at the Upper Union Mills, Pittsburgh, in 1884. They were followed by the rolling of 20-inch I-beams at the Homestead Steel Works in 1888. The 24-inch I-beams came along in 1889, and the 18-inch I-beams in 1897. In the early part of 1908 the Bethlehem Steel Company placed on the market Bethlehem structural shapes, that is, "H" column sections and wide flange beams, rolled on the "Grey Mill," which have proven to be a radical advance in the structural steel field, reducing the cost of fabrication and extending the use of structural steel in construction work. It was the production of these sections that has made possible and economical the steel skeleton building today.

Said a prominent writer on engineering subjects: "It is usually supposed that statistics are of value only to those who take delight in abstruse mathematical calculations, without regard to any material use or benefit derived therefrom, and that an ordinary man engaged in the useful pursuit of employment has little or no use in them." Yet beyond question, the statistics of an industry constitute an invaluable record of that industry development. As an index to the progress that has been made in the structural steel field during the past two decades let us take the output of steel shapes in this country, that is, beams, channels, angles, zees and tees, as shown by the following figures furnished by the Bureau of Statistics of the American Iron & Steel Institute, which give the production of structural steel shapes, not including plates, for each year:

	Tons.
1893	387,307
1894	360,305
1895	517,920
1896	495,571
1897	583,790
1898	702,197
1899	850,376
1900	815,161
1901	1,013,150
1902	1,300,326
1903	1,095,813
1904	949,146
1905	1,600,519
1906	2,118,772
1907	1,940,352
1908	1,083,181
1909	2,275,562
1910	2,266,890
1911	1,912,367
1912	2,846,487
1913	3,004,972

The above figures reflect very clearly the increased demand and output of structural steel shapes, year by year, for construction purposes.

Now what are the reasons for this evolution in building construction which has not yet reached a culmination and this phenomenal increase in the production of structural steel? It may be said that the steel skeleton building is of vital necessity within a large commercial center and that the natural expansion of commerce throughout the country would of itself have compelled the erection of these buildings regardless of the use of steel in their construction, but the point now made is, that the use of steel has made economical and safe their construction, and while causes act and interact among themselves, yet beyond question the economical and safe materials are the essential conditions of building construction. When steel was not the convenient and economical material that it is, other forms of construction were necessarily used, but today steel is the only material known to the engineering profession which is of unquestionable strength and reliability, readily obtained, convenient and easy to erect under any and all climatic conditions.

Besides this indisputable economy and convenience, there are other vital considerations which have led to the extensive use of steel as the ideal building construction. One of these is its fire-proof characteristics when properly protected by refractory materials. This, however, is not the principal reason, but is a very important one.

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Another reason, and one which we believe to be the chief factor that has caused this evolution and extensive use of steel for building purposes, has been the rapid increase in the cost of wood, as well as a great decrease in the quality of the timber which comes into the market today. It is to be noted from statistics furnished by the Bureau of Commerce and Labor that since the year of 1897, which was the year of great business depression, the price of timber of the grades used in building construction has practically doubled, and while the price of steel has been subject to great fluctuation and stands today, due to improved methods of manufacture, at relatively low figures, the price of lumber has steadily advanced. But the comparative first cost of wood and steel is not so very much of an item after all when compared with the much longer life of steel, convenience and economy in erection, etc.

Note—An article by Mr. C. H. Teesdale, which we print below, furnishes an illustration in point. (See page 205.)

Beyond doubt the development of the future lies in the rapidly increasing demand for steel in all classes of buildings and structures necessary for the commercial development of the country.

In some modern buildings, reinforced concrete will supplant steel and other materials of construction to a very considerable extent, particularly in low factory and industrial buildings covering large areas, for which it is especially suited and offers many advantages. But concrete can never take the place of steel, entirely, especially for high class office building construction in our large cities.

With this increase in the demand and production of structural steel and the resulting need for forcing the output of the mills to the utmost capacity, the necessity for a thorough inspection and test was felt by the steel designers and purchasers and it is interesting to note the progress and development that has been made in this direction.

It was probably in the dawn of the nineteenth century, when all the world was awakening to greater possibilities, that "testing" became a subject of special consideration. It is inconceivable that prior to that time there was no such thing as testing, but it should be remembered that that was long before the time when steam and electricity began to work their wonders; and long in advance of the days when steel and cement were enormous articles in trade.

In 1812 Samuel Brown, having improved his ship chains by scarf welding, also introduced a machine "which by enabling him to put as great a strain upon the cables as was likely ever to be brought upon them when in use, thus detected any defective materials or insufficient workmanship." This undoubtedly constituted the first real testing machine, and probably was the first effort to accord to purchasers the proof that materials were able to meet certain contemplated conditions. Brown's humble beginning founded a series of ample and worthy successors, and testing machines of all descriptions, not only for tension, but for compression and torsion, were eventually designed and built.

The advent of railroads and self-propelled vessels did much to hasten the development of the art of testing, because materials entering into the construction of machinery for such uses demanded the fulfillment of certain obligations, and care was therefore required in their selection. It was not, however, until the introduction of Bessemer and Open Hearth steels that testing began to assume such importance and study as is now attached to it. The tremendous advance made when these materials of construction began to be literally dumped onto the world brought up many questions of strength and quality as related to safety, and to most of these engineers and architects looked to the testing machine and inspection for answer. Purchasers of materials found it necessary to specify their desires more than ever, and the art of testing assumed new and more important phases. The productions of steel for structural purposes did more perhaps than any one thing, to separate testing into two more or less distinct branches, viz.: physical and chemical, for it was surely in connection with such manufacture that the science of chemistry began to be so intimately associated with the commercially structural side of life. Thus the field of testing was divided into the separate lines which, however, have ever since gone hand in hand.

At the present time no architect or engineer can well afford to overlook the very important matter of inspection and tests of materials entering into his construction work. In his design, he figures upon suitable materials to carry certain stresses, and it is only by thorough inspection and tests that he can assure himself and the owner that he is getting the materials and workmanship of the proper quality, as are covered by his specifications.

It is with this in mind that most architects and engineers embody in their specifications a requirement for inspection and test such as follows:

SUGGESTED INSERTION IN BUILDING SPECIFICATIONS COVERING MATTERS OF INSPECTION.

General.

All structural steel, cement and reinforcing steel shall be subjected to inspection and test by engineers and chemists, selected by the architects to perform this service. They shall be the agents of the architects and engineers, and shall report to them the results of inspection and the progress of the work, and otherwise facilitate the prompt and early delivery of satisfactory materials, and the contractor will furnish the necessary facilities for such inspection with minimum of inconvenience to inspectors.

The cost of this inspection is to be borne by the owner.

The inspection, acceptance or failure to inspect shall in no way relieve the contractor from his responsibility to furnish satisfactory materials; and the architect or engineer reserves the right to reject any materials, at any time, before the completion and acceptance of the structure if in his judgment it does not comply with the terms of the specifications or good practice.

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The contractor shall furnish the inspectors free of all cost all testing apparatus and prepared test specimens called for by this specification, and shall afford them ample facilities for proper inspection, including the necessary labor for handling materials under said specification.

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The inspectors shall have access to all parts of the mills, foundries or shops where the work is being done under this specification. In order to enable the inspector to keep close track of all material and to know the relative position of the same in the finished structure, the contractor shall furnish the inspector with complete copies of all orders for steel and iron which are placed with the mills or foundries.

The contractor shall furnish the inspector a complete set of all detail drawings after the same have been approved by the architect.

All material before leaving the mills or foundries shall be weighed and a copy of the shipping invoice showing the weights furnished the inspector within twenty-four hours after shipment.

All finished work before leaving the shop or foundry shall be weighed and the weight plainly marked on each main member. A copy of the shipping invoice showing the individual weights shall be furnished the inspector within twenty-four hours after the loading of accepted material. If there are no facilities for weighing, members shall be invoiced on net estimated weights computed from the shop drawings.

Cement.

The contractor shall furnish the inspectors free of cost all necessary facilities and labor for the sampling of the cement. Under the direction of the architect or engineer the inspectors may test the cement in their own laboratories or the laboratories of the cement mill. In the latter case they shall be furnished, free of cost, all materials and apparatus necessary for the performance of such tests as are specified.

If the architect or engineer so desire, the inspectors may permit the cement company to ship cement upon the satisfactory completion of the boiling test. The object of this is that the tests may be under way while the car or cars are in transit. This release of the cement shall be solely at the risk of the cement company, and said cement shall be rejected in case any of the other tests do not show satisfactory results.

No cement shall be used by the contractor until he has been notified by the architect or engineer that the material is satisfactory.

By C. H. TEESDALE,

In Charge of Wood Preservation, Forest Products Laboratory, Madison, Wis.

The north bleachers on the university athletic field, Madison, Wis., were torn down this summer because of decay. This stand seated over 5,000 people. It was built eleven years ago of Norway pine, at a cost of $4,500. It is not surprising that no attempt was made to protect the stand from decay by some preservative treatment when one considers that the greatest progress along that line has been made since these bleachers were erected. However, the case offers an excellent opportunity for a criticism of the practice of exposing untreated timber to attack by decay.

Joints Weakened.

A close examination was made while the bleachers were being wrecked and many members were found unfit to support their load, although the decay was generally confined to the joints. Rain water would run down the braces and collect at the joints where enough would be retained to keep the parts moist, making conditions very favorable to decay, as shown in the photographs. The braces seen in these photographs could carry very little loading.

The ground line is usually the point of most severe attack and about two years ago the ends of the upright columns had to be renewed, which was done by splicing with new material. Although the newer pieces were still in good condition the old columns had again become badly damaged where they were spliced. No doubt infection had extended up the column farther than was evident at the time the ends were removed and destruction continued rapidly, probably aided by the moisture collecting in the joints. Obviously the splicing should be done very carefully so as to remove all the infected material—which is difficult to determine—and in such a way the joint would not collect moisture. It is far better to avoid the necessity for such splicing by properly treating the timber at the start.

The upper ends of the columns were also decayed in the joints. It is evident that no part of the stand was free from the attack because of the distance from the ground, provided sufficient moisture was present. The seats also had decayed.

The need for a preservative treatment is evident. A good treatment is a matter of economy in practically every instance where wood is set subject to decay, and particularly so where decay which is confined to only a portion of a structure necessitates entire rebuilding, as in the case of this stand. The bleachers would have been in much better condition and would have given longer service if the joints and parts in contact with the ground had been given a thorough brush treatment with hot coal-tar creosote having a specific gravity of about 1.03 to 1.08 at 60 deg. C. A still better method would have been to treat all the lumber with about 0.5 lb. of zinc chloride per cubic foot and then give the ends and joints a subsequent brush treatment with creosote.

It is estimated that each end of the braces and supporting columns in this structure could have been painted with or dipped in creosote for less than $200. It is also estimated that all portions of the stand with the exception of the seats could have been given a treatment with zinc chloride for about $500, and the ends of those members in contact with the ground, or those trimmed or cut after treatment, could have been brush-treated with creosote for an additional $100, or a total cost of $600 for this treatment. The seats could have been built of a durable wood, for instance, heart cypress or redwood, at an additional cost of about $300.

Assuming an interest charge of 5 per cent per annum, a first cost of $4,500, and a life of eleven years, the annual charge against the untreated structure would be about $540.

If given a brush treatment with creosote at an additional cost of $200, the structure would have to last only 11.5 years to give the same annual charge.

If given a treatment with zinc chloride and creosote and using a durable wood for seats as suggested above, with a total increase in cost of $900, the structure would have to last about fourteen and one-half years to give an annual charge of $540.

It is estimated that in the first case suggested the structure would last at least fourteen years, and in the second case at least twenty years, reducing the annual charges to about $475 and $430 respectively, a saving of 12 per cent of the final cost on one and 20 per cent on the other.

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STANDARD SPECIFICATIONS FOR STRUCTURAL STEEL FOR BUILDINGS

Prepared by
AMERICAN SOCIETY FOR TESTING MATERIALS

Adopted August 16, 1909, and published in the Proceedings of the Fifteenth Annual Meeting, Vol. XII, 1912.

I. MANUFACTURE.

1. (a) Structural steel, except as noted in Section 1 (b), may be made by the Bessemer or the open-hearth process.

(b) Rivet steel, and steel for plates or angles over ¾ in. in thickness which are to be punched, shall be made by the open-hearth process.

II. CHEMICAL PROPERTIES AND TESTS.

2. The steel shall conform to the following requirements as to chemical composition:

Structural Steel: Bessemer, not over 0.10 per cent phosphorus; Open-hearth, not over 0.06 per cent phosphorus.

Rivet Steel: Open hearth, not over 0.06 per cent phosphorus.

3. To determine whether the material conforms to the requirements specified in Section 2, an analysis shall be made by the manufacturer from a test ingot taken during the pouring of each melt. A copy of this analysis shall be given to the purchaser or his representative.

III PHYSICAL PROPERTIES AND TESTS.

4. (a) The steel shall conform to the following requirements as to tensile properties:

Tensile Properties.

Properties Considered.	Structural Steel	Rivet Steel
Tensile strength, lb. per sq. in.	55 000 - 65 000	48 000 - 58 000
Yield point, min., lb. per sq. in.	0.5 tens. str.	0.5 tens. str.
Elongation in 8 in., min., per cent.	$\frac{1\ 400\ 000}{\text{Tens. str.}}$[1]	$\frac{1\ 400\ 000}{\text{Tens. str.}}$

[1]See Sections 5 and 6.

(b) The yield point shall be determined by the drop of the beam of the testing machine.

5. The percentage of elongation for pins shall be 5 less than that specified for structural steel in Section 4.

6. (a) For material over ¾ in. in thickness, a deduction of 1 from the percentage of elongation specified in Section 4 shall be made for each increase of ⅛ in. in thickness above ¾ in.

(b) For material under 5/16 in. in thickness, a deduction of 2.5 from the percentage of elongation specified in Section 4 shall be made for each decrease of 1/16 in. in thickness below 5/16 in.

7. All broken tension test specimens shall show a silky fracture.

8. (a) The test specimen for structural steel shall bend cold through 180 deg, around a pin the diameter of which is equal to the thickness of the specimen, without fracture on the outside of the bent portion.

(b) A rivet rod shall bend cold through 180 deg. flat on itself without fracture on the outside of the bent portion.

(c) Bend tests may be made by pressure or by blows.

9. (a) Tension and bend test specimens for structural steel shall be taken from the finished product, and shall be of full thickness of material as rolled.

Tension test specimens may be of the form and dimensions shown in Fig. 1; or with both edges parallel; or they may be turned to a diameter of ¾ in. for a length of at least 9 in., with enlarged ends.

Bend test specimens for material over ¾ in. in thickness may be 1 by ½ in. in section. The sheared edges of specimens shall be milled or planed.

(b) Rivet rods and small rolled bars shall be tested as rolled.

(c) Tension test specimens for pins shall be taken from the finished rolled or forged bar. The axis of the specimen shall be 1 in. from the surface of the bar, and shall be parallel to the axis of the bar.

10. (a) Material which is to be used without annealing or further treatment shall be tested as rolled or forged.

(b) Tension test specimens for material which is to be annealed or otherwise treated before use, shall be cut from properly annealed or similarly treated short lengths of the full section of the piece.

11. (a) At least one tension and one bend test shall be made from each melt. If material from one melt differs ⅜ in. or more in thickness, tests shall be made from both the thickest and the thinnest material rolled.

(b) If any test specimen develops flaws, or if a tension test specimen breaks outside the middle third of the gage length, it may be discarded and another specimen substituted.

12. If the results of the tension tests do not conform to the requirements specified in Section 4, retests may be made.

IV. PERMISSIBLE VARIATIONS IN WEIGHT AND GAGE.

13. The cross-section or weight of each piece of steel shall not vary more than 2.5 per cent from that specified; except in the case of sheared plates, which shall be covered by the following permissible variations to apply to single plates:

(a) **When Ordered to Weight.**—For plates 12½ lb. per sq. ft. or over:

Under 100 in. in width, 2.5 per cent above or below the specified weight;

100 in. in width and over, 5 per cent above or below the specified weight.

For plates under 12½ lb. per sq. ft.:

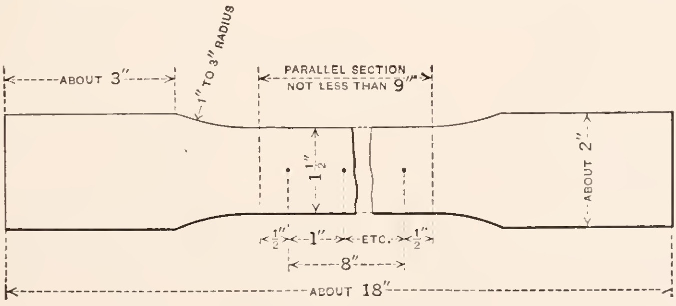

FIG. 1.

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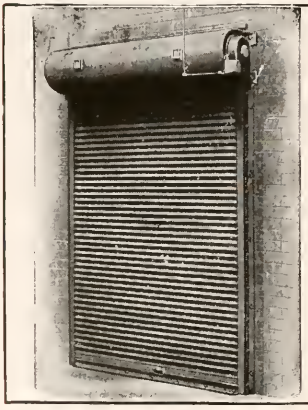

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75 to 100 in. in width, 5 per cent above or 3 per cent below the specified weight;
100 in. in width and over, 10 per cent or 3 per cent below the specified weight.

(b) **When Ordered to Gage.**—The thickness of each plate shall not vary more than 0.01 in. below that ordered.

An excess over the nominal weight corresponding to the dimensions on the order shall be allowed for each plate, if not more than that shown in the following table, one cubic inch of rolled steel being assumed to weigh 0.2833 lb.:

Thickness Ordered, in.	Nominal Weight, lb. per sq. ft.	Allowable Excess (Expressed as Percentage of Nominal Weight). For Width of Plate as follows: Under 50 in.	50 in. to 70 in.	70 in. and over.	Under 75 in.	75 In. to 100 in.	100 in. to 115 in.	115 in. and over.
1/8 to 5/32	5.10 to 6.37	10	15	20	..	..	..	..
5/32 to 3/16	6.37 to 7.65	8.5	12.5	17	..	..	..	..
3/16 to 1/4	7.65 to 10.20	7	10	15	..	..	..	..
1/4	10.20	..	..	..	10	14	18	..
5/16	12.75	..	..	..	8	12	16	..
3/8	15.30	..	..	..	7	10	13	17
7/16	17.85	..	..	..	6	8	10	13
1/2	20.40	..	..	..	5	7	9	12
9/16	22.95	..	..	.	4.5	6.5	8.5	11
5/8	25.50	..	..	..	4	6	8	10
Over 5/8	..	..	..	..	3.5	5	6.5	9

V. FINISH.

14. The finished material shall be free from injurious seams, slivers, flaws, and other defects, and shall have a workmanlike finish.

VI. MARKING.

15. The melt number shall be stamped on all finished material and on each test specimen. Rivet and lattice steel and other small pieces may be shipped in securely fastened bundles, with the melt number stamped on an attached metal tag.

VII. INSPECTION.

16. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests and inspection shall be made at the place of manufacture prior to shipment, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

Note.—For Robert W. Hunt's revision of Specification of The American Railway Engineers' Association "General Specification for Steel Railway Bridges, 1910" revised and supplemented to apply as General Specification for Structural Steel for Buildings, see Vol. XV of "Hand Book for Architects and Builders," published 1912.

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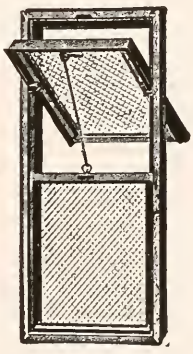

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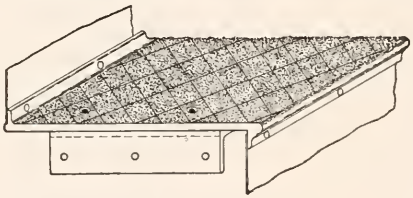

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THE FIRST STATE CONVENTION OF THE ARCHITECTS OF ILLINOIS

October 7th and 8th, 1914, will go down in history as red letter days for the architects of Illinois. It was fondly hoped and expected that this Convention would be a success, but the success attained was far beyond even the most sanguine expectation.

One of the great things about the convention that could not help but impress every one, was the spirit of harmony and co-operation.

The get-together slogan of the convention was literally put into practice from the start to the finish. Every one present took part in spirit if not in word.

The rapt attention which the speakers received, could not fail to inspire inexperienced speakers to flights of eloquence. From the first session to the last, the room was filled; men came to the convention from long distances, not on a pleasure excursion, but for hard, continuous convention work.

It may be conservatively asserted, that never has even a national convention gone through with such continuous enthusiasm and hearty co-operation of all in attendance.

The underlying sentiment which seemed to predominate all discussions and which were fed by all of the leading papers presented, were: First, the public good to be accomplished by better planning and design in all classes of buildings; second, the welfare of the individual essential to the welfare of the community; third, an injury to one member of the profession is an injury to all; fourth, a wrong act on the part of an individual member, is equivalent to a blot on the fair name of the entire brotherhood; fifth, it is incumbent on every architect to so conduct himself, as to command the respect of the community in which he lives; sixth, it is incumbent on every architect to do everything within his power to educate the public to a proper appreciation of what constitutes safe construction, sanitary building, artistic production and ethical business practice; seventh, wherever building laws, questions of city planning or landscape adornment are under consideration, it is the duty of the architect to make his influence felt in the right direction.

The architects of Illinois are to be congratulated that in addition to having an interesting, enthusiastic convention, the convention did not adjourn without having accomplished something. Over twenty resolutions were carefully considered and passed.

As an illustration of the enthusiasm of the convention: when the committee brought in a report recommending the holding of a regular biennial convention, the convention would not have it so, but unanimously voted to change the report in favor of an annual convention. They also voted to endorse the work of the Illinois Society of Architects, and to ask this Society to extend its work in the interest of better laws and more uniform law enforcement, so as to take in the entire state, and the members of the convention pledged their hearty support to the work of the Society. In fact, quite a large number of them filed application for Society membership.

It is impossible in this small space, to give an adequate idea of the magnitude of the work accomplished, but a full verbatim report of the proceedings of the convention will, in due course of time, be sent to all of the architects of Illinois.

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Cipher	Gay	Gaze	Gear	Gain	Gale	Gamy	Gang	Gap	Garb	Gash	Gait	Game	Gasp	Germ	Gift
Capacity, gallons per hour, 50 degree raise	200	300	400	500	600	800	1000	1200	1500	1800	1200	1500	1800	2200	2600
Capacity, garbage chamber one charge, bushels	1	2	3	2	3	4	5	7	9	12	6	8	9	11	12
Height over all, inches	58	64	64	56	56	56	56	56	56	56	69	69	69	71	71
Diameter of floor space required, inches	22	25	30	29x29	29x35	35x35	35x41	35x47	41x53	41x59	38x36	38x42	38x48	38x48	38x60
Height to bottom of front garbage door, inches	33	37	37	32	32	31	31	31	31	31	37	37	37	37	37
Dimensions of garbage door, inches	7x8	7x8	7x8	14x16	14x16	16x16	16x16	16x16	16x16	16x16	16x16	16x16	16x16	16x16	16x16
Dimensions of coal or fire door, inches	7x8	7x8	7x8	14x10	14x10	16x10	16x10	16x10	16x10	16x10	16x8	16x8	16x8	16x8	16x8
Diameter of coal or lower grates, inches	12	16	20	18x18	18x24	24x24	24x30	24x36	30x42	30x48	24x24	24x30	24x36	24x42	24x48
Size, flow and return flanges, two each, inches	1½	2	2	2	2	2½	2½	2½	3	3	3	3	4	4	4
Diameter of smoke pipe, inches	6	8	8	9	9	10	10	10	12	12	10	10	10	12	12
Approximate shipping weight, pounds	600	800	1000	1600	1800	2100	2300	2500	3000	3300	2800	3100	3400	3700	4000

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Capacity, Water, square feet	2600	3100	3600	4100	4700	5300	6200	7200	8200	9500	11400	13400	15500	17000	19600	21000	24500
Diameter Boiler....inches	36	36	36	42	42	42	48	48	48	54	54	60	60	66	66	72	72
Length Boiler over all....feet inches	8-7	10-2	11-7	9-10	11-4	12-11	12-4	13-10	15-4	15-10	18-4	17-10	20-4	18-4	20-4	18-4	20-4
Width of firebox....inches	30	30	30	36	36	36	42	42	42	48	48	53	53	59	59	65	65
Length of firebox....inches	45	51	57	54	60	66	66	72	78	78	84	90	96	90	96	96	102
Heating Surface....square feet	182	213	249	252	291	335	387	449	492	580	692	735	862	968	1092	1155	1310
Square feet of Steam capacity as rated for each square foot of heating surface	8.8	8.9	8.8	9.9	9.9	9.9	9.8	9.8	10.0	10.0	10.1	11.1	11.0	10.8	11.0	11.2	11.4
Area of upper grate....square feet	5.8	7.1	8.3	8.5	10.0	11.3	11.7	13.1	14.9	17.0	19.0	21.0	23.2	23.4	25.8	28.4	31.1
Square feet of heating surface for each square foot of grate	31	30	30	30	29	30	33	34	33	34	36	35	37	41	42	40	42
Diameter of Breeching....inches	20	20	22	22	22	24	24	27	27	30	30	34	34	36	36	38	38
Diameter of Stack....inches	18	18	20	20	20	22	22	24	24	28	28	32	32	34	34	36	36
Minimum height of Stack....feet	40	40	40	50	50	50	50	55	55	60	60	60	60	70	70	70	70
Diameter of Stack for two Boilers....inches	..	..	..	26	28	30	30	32	32	34	36	38	38	40	42	44	46
Minimum height of Stack for two Boilers....feet	..	..	..	60	60	60	60	60	60	70	70	70	75	75	80	80	80
Size of Steam opening (one)..inches	4	4	4	6	6	6	6	6	7	7	7	7	7	8	8	8	8
Size of Return (one)....inches	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6
Size of Safety Valve....inches	2	2	2	2½	2½	2½	2½	2½	3	3	3	3½	3½	3½	3½	4	4
Number and size of Supply and Return openings for Water....inches	2-5	2-5	2-6	2-6	2-6	2-6	2-6	2-7	2-7	2-7	2-7	2-8	2-8	2-10	2-10	2-10	2-10
Height of Water line....inches	59	59	59	61	61	61	65	65	65	67	67	75	75	80	80	86	86
Height from floor to top of brick work....inches	76	76	76	82	82	82	89	89	89	95	95	107	107	113	113	119	119

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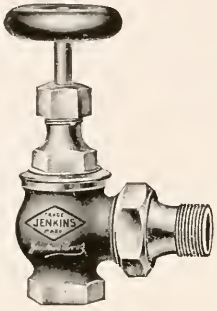

Fig. 168
Angle Radiator Valve

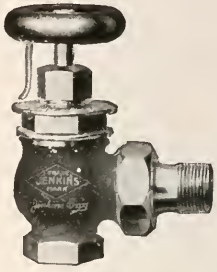

Fig. 300
Fractional Angle Radiator Valve

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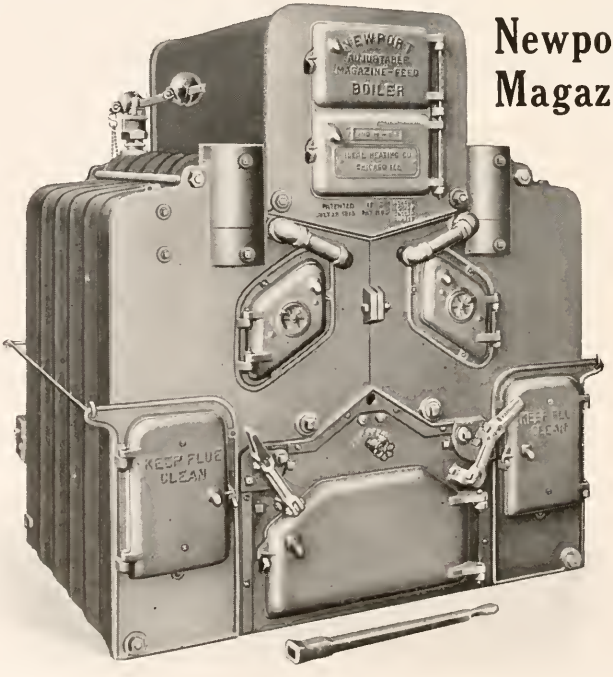

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HEATING AND VENTILATION

Edited by FRED J. POSTEL, Mech. Engr.

HEATING.

It is safe to say that in the majority of cases where the installation of a heating system is under consideration, the architect or engineer has a reasonable doubt as to whether he should install a steam or hot water system. It may be well, therefore, to consider some of the advantages and disadvantages of the two systems. In this comparison the simple gravity heating system is the one referred to.

Generally speaking, the advantage of the steam over hot water is lower first cost, smaller radiators and smaller piping. The principal disadvantage is the fact that the temperature of the radiating surface cannot be regulated to meet the demands of the weather conditions. Again, the system is operative only so long as there is pressure in the mains. If the pressure is allowed to fall to atmosphere, circulation ceases, and the building is, to all intents and purposes, without a heating system, even though there is a smoldering fire in the furnace.

The advantage of the hot water heating system is that the temperature of the water may be varied with the demands of the service. With a properly designed system the water circulates at a very low temperature, so that a smoldering fire will produce sufficient circulation in mild weather. This feature makes it possible also to continue heating the building after the fires have been banked for the night.

The principal disadvantages of a hot water system are the greater first cost, larger radiators and piping, and the ever present possibility of damage to decorations and furnishings, as a result of a leak in the system.

Numerous attempts have been made with varied success to overcome the disadvantages of both systems, but so far as I have found, none of these solve the problem for all conditions.

To provide for temperature regulation in a steam system two general systems have been brought out. One depends on throttling down the steam and discharging only enough into the radiator to provide the heat required. The other depends on air binding a certain number of loops in the radiator and operating the remaining loops at full pressure. The latter, of course, can be used only where compressed air is available and is used in connection with an automatic system of temperature regulation.

To overcome the disadvantage of large, ungainly radiators and piping in hot water systems, various devices have been used to increase the temperature of the water under conditions of extreme demand. These systems depend on increasing the pressure on the water above atmosphere, and are what may be referred to as closed systems, either wholly or in part.

STEAM HEATING.

In designing a system of steam heating, it should first be determined whether the conditions will be best met by a gravity, or a vacuum system.

In a gravity system, the mains and radiating surface are so laid out that all condensation returns to the boiler by gravity and no machinery is required to keep the system in operation. This system is necessarily operated at a pressure above atmosphere so that the pressure in the radiators is sufficient to expel the air from the system.

A vacuum system may be either a "dry" or "wet" system. In the dry system a vacuum is maintained on air valves which are intended to handle air only. In a wet system the condensation and the entrained air are removed through the same pipe.

There are a number of modifications of these two systems, but broadly speaking, all steam systems may be classed either as "gravity" or as "vacuum" systems.

In determining whether the expense of a vacuum system is justified by the conditions, the advantages to be obtained by using it must be carefully considered. The two things which make a vacuum system better than a gravity system are, first, circulation at a lower pressure; second, quick circulation when new radiation is turned on. The former is of particular importance in cases where the exhaust steam from engines is used to heat the building. The efficiency of the engine is increased as the back pressure is decreased. Therefore, the use of a vacuum system may be the means of saving considerable coal. On the other hand, the installation of a vacuum system cannot be justified from the standpoint of economy in coal consumption, if the demand for exhaust steam is so heavy that live steam must be used to make up the deficiency, even with the engine running against a back pressure.

Vacuum systems are sometimes installed where there are no engines and where the system might as well operate at 5 lbs. as at ½ lb. back pressure. The net cost of operating such a system is necessarily greater than would be the case in a gravity system and the only advantage is a somewhat freer circulation, and the fact that the radiators will heat up promptly when the inlet valves are opened.

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size should circulate freely with one pound pressure under all ordinary conditions and with not to exceed two pounds pressure in extreme cold weather, when the demand for steam and therefore the velocity of the steam in the pipes reaches a maximum. A vacuum system should not require to exceed one-half pound pressure under any condition.

A gravity system may be either a "one-pipe" or a "two-pipe" system and either of these may be an "up-feed" or a "down-feed" system. Except in the case of very high buildings equally good results can be obtained with either up-feed or down-feed, but where the building is very high there is an advantage in having a down-feed system.

A vacuum system may be either up-feed or down-feed, but will always be a two-pipe or a three-pipe system. The wet vacuum system is always necessarily a two-pipe system. The dry vacuum system when used in connection with cast iron radiation is usually a two-pipe system, the vacuum pipe being a very small pipe with probably ¼-inch branches and a main seldom larger than one inch. Where the dry vacuum system is applied to a coil system of heating in which the steam and returns are separate, the vacuum pipe will be required in addition to the other two, thus making a three-pipe system.

Inasmuch as loss of heat from buildings is by radiation and conduction from walls and windows and by the air which must be replaced by new air for ventilation, heating formulae must necessarily involve the quantities, area of exposed wall, area of glass and the cubical contents, the last being in connection with frequency of changes of air.

The loss of heat through walls of buildings depends on the construction and thickness and the materials used, and on the difference of temperature between outside and inside surfaces.

The amount of heat passing through walls, and glass expressed in B. T. U. per hour, per square foot of surface, per degree difference of temperature is approximately:

1/3 B. T. U. for an 8″ brick or stone wall.
1/20 B. T. U. for an 8″ (solid) wood wall.
1/4 B. T. U. for a 12″ brick or stone wall with air space.

1 B. T. U. for a single thickness of glass.
2/3 B. T. U. for a double thickness of glass (air space between).

For ordinary temperatures and pressures 55 cubic feet of air would require 1 British Thermal Unit per degree rise of temperature.

The foregoing, together with the fact that heat emitted from radiating surfaces per square foot, per hour, per degree difference of temperature above that of surrounding air is 1.8 British Thermal Units when radiating surface is 150 degrees above temperature of surrounding air to 1.7 British Thermal Units, when radiating surface is 110 degrees above temperature of surrounding air furnish a basis for estimating the amount of radiating surface required.

There are a great number of heating formulae in use and it is seldom that the results figured by these various formulae will agree. The formulae are all empirical formulae and are based on average conditions. If the conditions of any particular case vary considerably from the average, it is quite likely that none of the formulae will give correct results. For example, if a room with excessive exposure or an unusually large amount of glass, or a very large volume and comparatively small amount of glass is figured by one of these formulae, the results are bound to be unsatisfactory.

Allowance must, therefore, always be made with any of the formulae for local conditions and for this reason the writer has always made it a practice to use a factor "C" in all formulae, this factor being dependent upon the local conditions.

A simple formula which is sometimes used, but which is rather crude and not entirely accurate, is as follows:

Heating surface = ½ of net glass area plus 1/20 of net wall area plus 1/200 of cubic contents.

Mr. Linn, in his article on this subject in Vol. XIV of the "Hand Book", gives several formulae for calculating the radiating surface, any one of which will be found quite satisfactory. The following is one of these, summarized and reduced to algebraic statement:

W = Gross exterior area less "G" in sq. ft. of exposed walls of the room, for which radiation is to be computed, including area of ceiling where room or space above is not heated.

G = Area in sq. ft. of exterior window and exterior door openings measuring the entire wall opening for window and door-frames of room to be heated.

V = Cubic foot contents of the room to be heated.

L = Factor for lowest recorded exterior temperature. Determine lowest recorded exterior temperature from weather bureau reports, then find "L" in table below corresponding. For Chicago this is — 20°, therefore L = 1.14, for Chicago.

Lowest recorded temperature for the locality.	L	Lowest recorded temperature for the locality.	L
— 45°	1.5	— 10°	1.
— 40°	1.43	+ 0°	.93
— 35°	1.36	+ 5°	.86
— 30°	1.29	+ 10°	.79
— 25°	1.21	+ 15°	.71
— 20°	1.14	+ 20°	.64
— 15°	1.07	+ 25°	.57

Q = Radiation required to heat the room to 70° Fah. under average conditions.

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C = Factor for local and special conditions exposure, etc., fixed by the judgment of the estimator to cover conditions varying from the average.

T = Factor for thickness of enclosing walls.

T = 10 for walls 8 to 10 inches thick.
T = 15 for walls 12 to 26 inches thick.
T = 20 for walls 26 to 38 inches thick.
M = Factor for method of heating.
M = .0055 for steam heating.
M = .0072 for hot water in radiators 180°.
M = .0081 for hot water in radiators 170°.
M = .0092 for hot water in radiators 160°.

Note—If water is 175 degrees in flow and 145 degrees in return, the average is 160 degrees, and is the temperature which should be expected in radiators under these conditions.

Formulae for computing either steam or hot water radiation required in any room in any building in any location:

$$\left[\left(\frac{W}{T}+G\right)75+V\right]M=Q$$

Q = Average Radiation Required

QC = Special radiation required.

Above formula is based upon using direct radiation and provides for one change per hour. For more frequent changes increase the cubic contents by as many times as it is desired to change the air per hour, the other factors remain the same.

"Direct" radiation is surrounded by warm air, but cold air comes in contact with the surface, in "Direct-indirect" and "Indirect" systems to a greater or less extent; so that for "Direct-indirect" radiation add 25 per cent and for "Indirect" radiation add 50 per cent.

SIZES OF STEAM MAINS.

Radiation	One Pipe Work	Two Pipe Work
125 sq. ft.....	1½ in.	1¼×1 in.
250 sq. ft.....	2 in.	1½×1¼ in.
400 sq. ft.....	2½ in.	2 ×1½ in.
650 sq. ft.....	3 in.	2½×2 in.
900 sq. ft.....	3½ in.	3 ×2½ in.
1250 sq. ft.....	4 in.	3½×3 in.
1600 sq. ft.....	4½ in.	4 ×3½ in.
2050 sq. ft.....	5 in.	4½×4 in.
2500 sq. ft.....	6 in.	5 ×4½ in.
3600 sq. ft.....	7 in.	6 ×5 in.
5000 sq. ft.....	8 in.	7 ×6 in.
6500 sq. ft.....	9 in.	8 ×6 in.
8100 sq. ft.....10	in.	9 ×6 in.

HOT WATER HEATING.

In hot water heating the system may be a one-pipe or two-pipe system, or may be a gravity circulation system or a forced circulation system.

The gravity circulation system is dependent for circulation upon the fact that cold water is heavier than hot water. Therefore, the pitch of supply line should be upward from the boiler (which is the reverse of the requirement in steam heating) and the return should pitch downward toward the boiler as is the case, also, in steam heating.

In forced circulation systems which must be used when long horizontal runs are encountered, as is the case in factory heating, where the boiler or source of heat is in a detached power plant, a pump must be employed.

In one-pipe systems the radiators are connected in shunt with the supply lines, that is, the water to a radiator is taken from supply line, passes through radiator and is returned to supply line at a point further along in the direction of the travel of the water. Special fittings are sometimes employed in the diversion of the water into the radiators, especially in the case of forced circulation systems.

Two-pipe systems, especially in gravity circulation systems, may be considered to have more positive circulation.

Either one-pipe or two-pipe, or gravity or forced circulation systems may be closed or open systems, though closed systems are rarely found except in larger forced circulation systems. In either system an expansion tank must be used because of the expansion of water as its temperature rises.

The formulae which are used in estimating the amount of radiating surface required for steam heating may be used for computing the amount of radiating surface required for hot water heating, providing a factor dependent upon the difference in temperature of the hot water and of the steam is introduced.

SIZE OF HOT WATER MAINS.

(For gravity circulation and low buildings.)

Size of Main	Area	Direct Radiation Will Supply, Feet	Indirect Radiation Will Supply Feet
1½ in.	2.03	200	135
2 in.	3.35	325	200
2½ in.	4.78	450	300
3 in.	7.38	700	450
3½ in.	9.82	900	600
4 in.	12.73	1200	800
4½ in.	15.93	1500	1000
5 in.	19.99	2000	1200
6 in.	28.88	3000	2000
7 in.	38.73	4200	2800
8 in.	50.03	5600	3600
9 in.	63.63	7000	4600
10 in.	78.83	8500	5600

In forced circulation systems it is considered good practice to so proportion mains and returns that velocity of water will not exceed 200 feet per minute.

Carpenter gives as a practical rule, applicable when main and supply do not exceed 200 feet in length, "The diameter of main supply or return pipe in a system of direct hot water heating should be one pipe-size greater than the square root of the number of square feet of radiating surface, divided by 9 for the first story, by 10 for the

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second story and by 11 for the third story of the building. For indirect hot water, multiply above by 1.5".

BOILERS FOR HEATING SYSTEMS.

Boilers sold for heating installations are rated by manufacturers in square feet of radiating surface, which they will supply. Comparison of boilers sold by different manufacturers discloses the fact that boilers of different makes, having the same amount of heating surface have widely different ratings, as given by the manufacturers; the difference being in some cases nearly 100 per cent.

The capacity of a boiler depends on the form and extent of the heating surface, the water and steam space and upon the amount of grate surface.

A boiler horse power is arbitrarily defined as the evaporation of 34½ pounds of water per hour from a temperature of 212 degrees to steam at atmospheric pressure, which, as the evaporation of one pound of water under these conditions requires 965.7 British Thermal Units, is the equivalent of 33,316 British Thermal Units. As one square foot of direct steam radiating surface emits approximately 250 British Thermal Units per hour a boiler horse power should supply 133 square feet of radiating surface.

To allow for less efficient management of heating boilers than of power boilers, however, it may be considered good practice to limit the radiating surface which may be supplied by one boiler horse power to 100 square feet.

The heating surface required per boiler horse power in power boilers usually ranges from 7½ to 12 square feet, dependent upon the kind of boiler. For heating service, it seems safe to assume that the heating surface per boiler horse power, or per 100 square feet of radiation supplied should rarely be less than 15 square feet.

In power boilers the ratio of grate surface to heating surface usually ranges from 1 to 40, to 1 to 60. In boilers for heating service the ratio of grate surface to heating surface should not be less than 1 to 40 and preferably more.

The satisfactory operation of any boiler is dependent upon sufficient draft as well as upon other conditions. Sufficient draft is obtained by proper chimney proportions.

CHIMNEYS.

Kent gives the following:

The commonly accepted theory of chimney draft based on Peclet's and Rankine's hypotheses (see Rankine, S. E.), is discussed by Prof. De Volson Wood in Trans. A. S. M. E., Vol. XI.

Peclet represented the law of draught by the formula

$$h = \frac{u^2}{2g}\left(1 + G + \frac{fl}{m}\right)$$

in which "h" is the "head," defined as such a height of hot gases as, if added to the column of gases in the chimney, would produce the same pressure at the furnace as a column of outside air, of the same area of base, and a height equal to that of the chimney;

"u" is the required velocity of gases in the chimney;

"G" a constant to represent the resistance to the passage of air through the coal;

"l" the length of the flues and chimney;

"m" the mean hydraulic depth or the area of a cross-section divided by the perimeter;

"f" a constant depending upon the nature of the surfaces over which the gases pass, whether smooth, or sooty and rough.

Rankine's formula (Steam Engine, p. 288), derived by giving certain values to the constants (so-called) in Peclet's formula, is

$$h = \left[\frac{\frac{T_0}{T_2}(0.0807)}{\frac{T_0}{T_1}(0.084)}\right] H - H - (0.96\,\frac{T_1}{T_2} - 1)H$$

in which H = the height of the chimney in feet;

T_0 = 493° F. absolute (temperature of melting ice);

T_1 = absolute temperature of the gases in the chimney.

T_2 = absolute temperature of the external air.

SIZES FOR CHIMNEYS.

A very essential adjunct to the working of a plant is the chimney flue, and the form of the flue has much to do with its effectiveness; thus as gases ascend in a spiral motion a round flue is the best, and a square one is better than one of rectangular shape. If of brick it should be evenly plastered. The flue should extend below the smoke pipe connection only a short distance to permit the removal of soot; if continued far below it will form an air pocket and cause down currents.

Sq. Feet of Direct Steam Radiation	Horse Power	Size of Chimney	Sq. Feet of Direct Water Radiation
250	2.5	8″x 8″x25′	400
500	5.0	8″x12″x30′	850
800	8.0	12″x12″x35′	1350
1400	14.0	12″x16″x40′	2400
2200	22.0	16″x16″x50′	3700
3500	35.0	18″x18″x60′	5900
5500	55.0	20″x20″x70′	9300
8000	80.0	24″x24″x80′	13000

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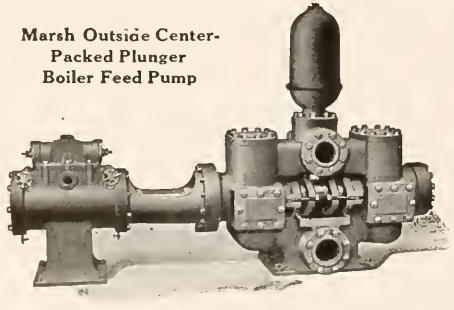

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ment be supplied with at least one of the temperature controlling instruments called "thermostats," this "thermostat" regulating automatically the sources of heat supply for the apartment in which it is placed.

If the system of heating be direct radiation, the control of the radiators is accomplished by means of pneumatic diaphragm valves taking the place of the ordinary hand valves, these pneumatic valves being connected with the "thermostat." If indirect heat is used, the passage of the warm air through the heat flues is usually controlled by "mixing dampers," so arranged as to automatically mix hot and cold air in the proper proportions before it reaches the apartment, these mixing dampers being under the control of the "thermostats."

The heat regulation systems of recognized standing are generally operated by compressed air supplied by a suitable compressor in the basement, and distributed throughout the building by a system of galvanized iron and lead piping. The manufacturers of these systems invariably install the apparatus themselves, either as principal or sub-contractors, but in all cases executing to the owner a guarantee covering the operation and care of the system. The evidence seems to show that a saving of from 15 to 25 per cent in fuel consumption is accomplished in those buildings which are equipped with automatic heat regulation. This is a sufficiently large return upon the cost of the apparatus to justify its use in the majority of buildings. In theaters, assembly halls, schools, etc., its use is imperative for hygienic reasons as well.

The question of the control of the humidity is almost as important as the question of control of temperature. It is safe to say that during the heating season, the humidity in 90% of the buildings is far below what it should be for health and comfort. The Chicago Commission on Ventilation have made some experiments to determine the relative humidity which will give the greatest comfort to the occupant of the room at given temperatures. This data is now being published in pamphlet form.

VENTILATION.

The term ventilation, when used in the ordinary sense is a purely relative term. Every room or building, unless it is hermetically sealed is "ventilated" to a certain extent. A room heated with steam or hot water direct radiation and with all the windows and doors closed is ventilated by the amount of air leakage, due to the fact that neither the doors nor windows nor even the walls are air tight and there is a constant tendency for the interchange of air from the outside to the inside of the building. With the indirect system of heating, fresh air from the outside is introduced at a definite point and by means of a system entirely under control at all times.

The ducts supplying the air to the indirect radiation are usually provided with dampers, so that the amount of fresh air can be absolutely regulated. From the standpoint of ventilation, indirect radiation is far superior to direct radiation, but on account of the very much greater cost of operation, the amount of indirect radiation is usually restricted to one or two stacks in the ordinary residence.

The fan system of heating and ventilating is desirable from the ventilating standpoint to just the extent that fresh air is drawn from the outside. It should be understood that it is possible to operate a fan system, drawing the entire supply from the inside of the building. In this case, even though there is a movement of air, the ventilation is no better than with the ordinary direct radiation system. On the other hand, if all the air is taken from the outside, this system will provide the very best of ventilation. In actual practice, for purposes of economy, fan systems are usually operated to take most of the air from the outside, but a by-pass is provided, so that in extreme cold weather part of the air can be drawn from the inside of the building.

Quite frequently a combination of a direct heating system and a fan ventilation system is used. In such cases the heating system is usually designed to provide sufficient temperature under all weather conditions. The fan ventilating system is designed to supply sufficient air to maintain a pre-determined standard of purity and is then provided with just sufficient radiation to heat this air to the room temperature. In other words, the direct radiation is depended upon for heat and the fan system is depended upon to furnish the ventilation only.

In laying out any system of ventilation it is necessary to decide first of all on the standard of purity to be maintained. Pure country air contains about four parts of CO_2 in 10,000. This amount of CO_2 can be increased to 6, 8 and even 10 parts without any bad results to the occupants of the room. Naturally there is no sharp, well defined line above which ventilation is totally bad or below which the ventilation may be referred to as absolutely good. As a general proposition, it may be said, however, that a system of ventilation which permits the CO_2 to rise above 12 parts in 10,000 is not a good modern ventilating system, while on the other hand, for commercial reasons, it is seldom that an attempt to keep the air purer than 6 parts of CO_2 in 10,000 is made.

This assumes that CO_2 is not the only impurity in the air, but rather is an indicator of the presence of other impurities as well. In other words, an artificial mixture of twelve parts of CO_2 in 10,000 would not contain the same amount of impurities and would, therefore, not represent the same degree of ventilation as the air in an assembly hall containing twelve parts of CO_2 in 10,000.

In calculating the probable impurities, it may be assumed that the ordinary person in average good health, exhales 0.6 of a cubic foot of CO_2 per hour and a "5-foot" gas

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burner vitiates about five times as much air as the ordinary person. A gas grate or any open fire-place, on the other hand, has a tendency to improve the ventilation; for while it uses up oxygen, it must be kept in mind that all the gases which pass up the chimney, must in the natural course of events be replaced by fresh air through the doors and windows.

As incandescent electric lights use up no oxygen, they have no effect on the ventilation of a room. In hospitals the amount of fresh air required for occupants is naturally much greater than in buildings occupied by persons in good health. The amount of fresh air per occupant must be doubled and some times trebled to maintain the required standard of purity.

In laying out a fan system of ventilation, great care must be taken to avoid drafts. Where air is introduced at or near the ceiling, a register velocity of 600 feet per minute is permissible, but where air is introduced at or near the floor line, the velocity must not exceed 200 feet per minute as a maximum, and in many cases where the best results are desired, the velocity is kept down to about 125 feet per minute. The velocity through the register of a vent flue may be very much greater than through a fresh air register. Except where the register is so located as to directly expose the occupants of the room to a draft, it is not unusual to permit a register velocity of 600 feet per minute.

In no case are register velocities over 600 feet per minute desirable because even though the register may be so located that there may be no trouble from draft, there will be a distinct "humming" noise which is disagreeable.

The Chicago Commission on Ventilation have made a series of tests on the ventilation of theatres and public conveyances. They have also made some very instructive experiments on the effect of impurities in the air, using for this purpose an air-tight cabinet. Provision was made to regulate the quantity, as well as the quality, of air supplied to the occupant of the cabinet. Results of these tests are now being published and copies can be obtained from the Secretary of the Commission.

TABLE OF EQUIVALENT TEMPERATURE FOR TESTING A HEATING PLANT AT DIFFERENT OUTSIDE TEMPERATURES.

For the purpose of indicating the efficiency of the apparatus for any specified condition, Prof. Carpenter gives the following table, which has been generally accepted as the standard test.

For steam, the radiator temperature in all cases is assumed to be that due to a pressure of 3 pounds at the boiler, or about 220° Fahr.

For water, the radiator temperature is assumed in all cases to be at an average of 160° Fahr.

For a plant proportioned sufficiently to maintain a temperature of 70° when the outside temperature is at zero.

Temperature of Outside Air	Room should be raised to
—10	64.7
0	70.0
10	75.1
20	81.0
30	86.5
40	93.1
50	98.7
60	104.7
70	110.5
80	117.1
90	123.5
100	130.3

See University of Illinois Engineering Experiment Station Bulletin No. 31 for methods and results of tests on house heating apparatus. These tests have been made on different kinds of house heating apparatus with different kinds of fuel. The bulletin embodies the results of about three hundred tests. These bulletins are for free distribution.

EXPANSION AND CONTRACTION.

Scarcely anything can withstand the expansion of iron. It expands from 23° to 212°, about 1/900 of its length, which in 100 feet equals 1⅜ inches. The expanding power of a 2-inch pipe when heated to a temperature of 100 pounds steam, or to 338°, exerts a force sufficient to move 25 tons.

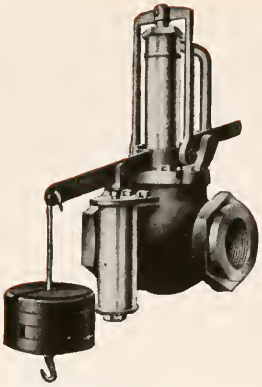
Cast iron expands 1/162000 of its length for each degree Fahr. it is subjected to within ordinary limits while in its solid state.

Wrought iron expands 1/150000 of its length for each degree Fahr. To find the expansion of a line of pipe, multiply its length in inches by the number of degrees of temperature applied and divide the product by 150,000 for required expansion in inches; thus 100′ × 12″ = 1200 × 338° = 405600 ÷ 150000 = 2.7 inches.

For example: find the lineal expansion in a wrought iron pipe 100′ long, containing steam at 338°. Expansion equals 100′ x 12″ x 338°, divided by 150,000, equals 2.7″.

Special attention, then, must be given to the expansion and contraction of pipes and allowance made for it. Pipes and branches must be unconfined, especially in the direction of their length.

Expansion joints should not be used if the expansion can be compensated for in any other way.



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RADIATION OF HEAT.

Radiation of heat takes place between bodies at all distances apart, and follows the laws for the radiation of light.

The heat rays proceed in straight lines, and the intensity of the rays radiated from any one source varies inversely as the square of their distance from the source.

This statement has been erroneously interpreted by some writers, who have assumed from it that a boiler placed two feet above a fire would receive by radiation only one-fourth as much heat as if it were only one foot above. In the case of boiler furnaces the side walls reflect those rays that are received at an angle—following the law of optics, that the angle of incidence is equal to the angle of reflection,—with the result that the intensity of heat two feet above the fire is practically the same as at one foot above, instead of only one-fourth as much.

(Incidentally, where the boiler is sufficiently far removed from the grates to permit of thorough combustion of the gases, the intensity of the heat is greater than where the boiler is set lower.)

The rate at which a hotter body radiates heat, and a colder body absorbs heat, depends upon the state of the surfaces of the bodies as well as on their temperatures. The rate of radiation and of absorption are increased by darkness and roughness of the surfaces of the bodies, and diminished by smoothness and polish. For this reason the covering of steam pipes and boilers should be smooth and of a light color; uncovered pipes and steam-cylinder covers should be polished.

The quantity of heat radiated by a body is also a measure of its heat-absorbing power, under the same circumstances. When a polished body is struck by a ray of heat, it absorbs part of the heat and reflects the rest. The reflecting power of a body is therefore the complement of its absorbing power, which latter is the same as its radiating power.

The relative radiating and reflecting power of different bodies has been determined by experiment, but as far as quantities of heat are concerned, says Prof. Trowbridge (Johnson's Cyclopaedia, art. Heat), it is doubtful whether anything further than the said relative determinations can, in the present state of our knowledge, be depended upon, the actual or absolute quantities for different temperatures being still uncertain. The authorities do not even agree on the relative radiating powers.

HEATING BY ELECTRICITY.

Heating by electricity is entirely feasible and practical where the cost of electric current is very low. At the ordinary prevailing rates, however, the cost is prohibitive. The reason for this is that where electricity is generated in a steam plant using simple engines, only about 4% of the B. T. U. in the steam is delivered to the switchboard in the form of electrical energy. In stations where the highest type of generating apparatus is used, this percentage may be increased to 12% or 13%.

While the large power boiler is more economical in the production of steam than the small heating boiler, the fact that only 4% to 13% of the steam generated by the large power boiler is available as electrical energy makes the cost of this form of heating prohibitive.

STEAM BOILER AND PIPE COVERINGS.

Experiments under actual steam plant conditions, conducted by Geo. M. Brill (Trans. Am. Soc. Eng. Vol. XVI) show that in ordinary practice the early results and theories, advanced by Sir Isaac Newton and Peclet, are too low. He found that by using an 8 inch bare steam pipe 60 feet long with an average pressure of 110.5 lbs. by gauge, and with air 75.5 degrees Fahrenheit, that 736.546 B. T. U. per square foot of surface per hour, were lost. These results accord so closely with the experiments conducted by Prof. R. C. Carpenter of Cornell University, and Prof. M. E. Cooley of the University of Michigan, that it seems fair to use these results as a premise of calculation in practical work The magnitude of the loss from a bare pipe can be understood possibly more closely by the following calculation:

Adopt from Mr. Brill's results a loss of 736.546 B. T. U. per square foot of surface per hour and, assuming an 8-inch pipe to be 100 feet long, the loss would then be as follows:

736.546 B. T. U. multiplied by 225 square feet (surface of an 8-inch pipe 100 feet long) equals 165722 B. T. U. lost per hour or, divided by 30,000 B. T. U., heat units in one horse-power at above pressure (assuming 34½ lbs. of water from and at 212 degrees to be a horse-power) equals 5.5 horse-power per hour lost. The method adopted for preventing in a measure this loss is by the application of some non-conducting material to the radiant body, having for its object the protection of the external surfaces from loss of heat and from any injurious action liable to occur in consequence of their exposure. It will therefore be seen that a great economy is effected by the application of pipe covering or boiler lagging.

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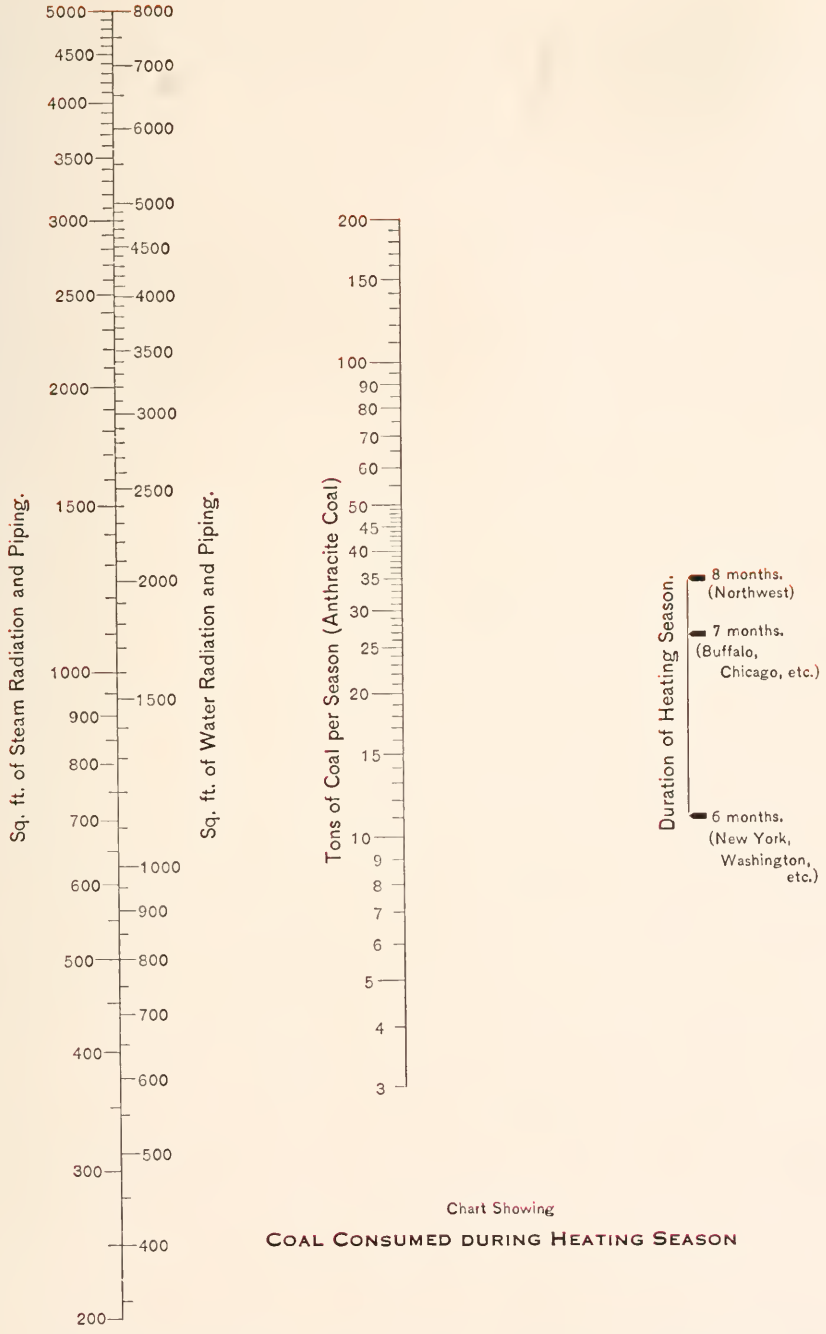
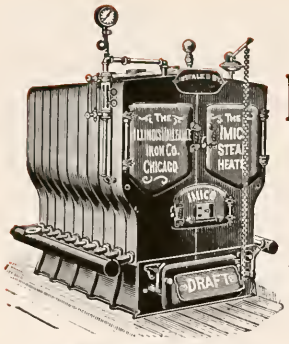


Chart Showing

Coal Consumed during Heating Season

To use the chart, select point on left-hand vertical line indicating square feet of radiation and piping. Connect this point by means of straight edge with point on right-hand vertical line indicating duration of heating season. When the straight edge crosses the middle vertical line indicates the approximate amount in tons of anthracite coal required per season.



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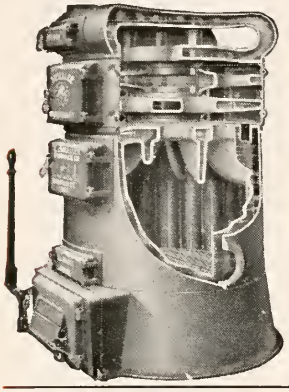

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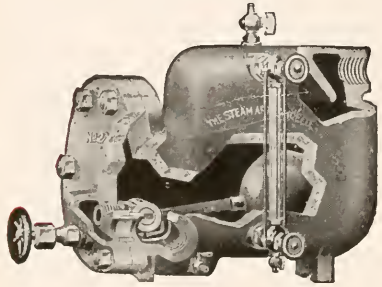

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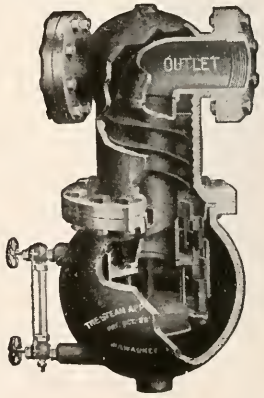

OFFICE PRACTICE

Circular of Advice by Illinois Society of Architects Adopted April 28, 1914.

Believing that uniform practice in various architects' offices is desirable for all concerned, this Society recommends that the following conditions prevail in architects' offices of the State of Illinois:

Classification of Employes.

First. That employes be classed as Regular and Special;

Second. Employes classified as "Regular" will be those continually engaged for a period of not less than one year, on a weekly salary basis; it is expected that such employes will assume greater responsibilities to their employers and be granted special privileges, in consideration of faithful service;

Third. Employes classified as "Special" will be those engaged temporarily. It is deemed proper that such employes be paid by the hour for actual service rendered, making no allowance for vacations or holidays, it being considered fair under these circumstances to allow these draughtsmen a slightly higher rate per hour than regular employes who enjoy privileges of vacations and holidays.

Office Hours.

First. It is understood that draughtsmen are expected to be in their respective offices ready to begin actual work at the hours stated, and that they will continue in service at least until the hours fixed for cessation of work;

Second. The regular opening time of offices shall be 8:30 A. M., throughout the year;

Third. Period of service for Monday, Tuesday, Wednesday, Thursday and Friday, in the morning, shall be four hours, extending to 12:30 P. M.; that the lunch hour shall be one hour, extending from 12:30 to 1:30 P. M.; that the afternoon period shall be four hours, extending from 1:30 to 5:30 P. M.;

Fourth. That the Saturday period of service shall consist of 4½ hours, extending from 8.30 A. M. continuously to 1:00 P. M.

Units of Service.

First. One week's service will consist of 44½ hours;

Second. One year's service will consist of 2,180½ hours.

Pay-Day.

First. That pay-day shall be on Monday of every week;

Second. That each pay-day draughtsmen be paid up to the Saturday night preceding.

Holidays and Vacations.

First. We recommend that "Regular" draughtsmen be given the following holidays on full pay: New Year's, Decoration Day, July Fourth, Labor Day, Thanksgiving, Christmas;

Second. That all "Regular" draughtsmen having been in the employ of an architect for more than one year be given two weeks' vacation on full pay, at time most convenient for employer;

Third. It should be understood that "Regular" draughtsmen, quitting the employer's service of their own volition, preceding the completion of any year's service, shall not be entitled to vacation allowance;

Fourth. "Regular" employes terminating service at the request of their employer shall be entitled to an allowance in cash proportionate to two weeks' salary allowed for vacation in the same ratio as period of service bears to one year;

Fifth. Vacations and holidays are understood to be granted to employes for rest and recuperation, the employe being understood to be in the service of the employer during vacation and holiday time just to the same extent as when regularly engaged in the office;

Sixth. It is recognized that an average of 44½ hours per week's service is the maximum efficient service that can be continuously rendered without detriment to the health or efficiency of the employe, and that where the employe engages in outside architectural service of any sort for others, he does so at the expense of his employer, and his employer should be credited for corresponding loss of time. The practice of employes of one employer working nights or holidays for another is condemned as detrimental to the best interests of both employer and employe;

Seventh. In case of emergencies of short duration, "Regular" employes are expected to work over-time for the employer without extra remuneration other than a reasonable allowance for the expense of taking meals away from regular lodging place. In such cases, however, the employes will be credited with off time on account of sickness or otherwise, equivalent to the amount of overtime service rendered in cases of emergency;

Eighth. Draughtsmen are encouraged, however, to make use of a portion of their time off for educational improvement.

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LOCATION OF HARDPAN IN RELATION TO CITY DATUM

Note: We present the following records of borings taken from the reports on file at the Chicago Academy of Science by representatives of the Western Society of Engineers. To use this table for determining the probable depth of hardpan below the surface, find the East and West street nearest the location of site; then in the table under that street heading trace down to the nearest North and South street to proposed site, where read record of nearest recorded information as to depth of soil suitable for heavy foundation. This process may be repeated for different locations in the vicinity to determine the general lay of hardpan. We understand that most of this data has been accumulated by the Academy of Science from the records of borings made for existing structures, including track elevations and buildings.

ADAMS ST.

Feet

Michigan Ave. Gas Bldg. ..—87.2 & —89.3
Michigan Ave. .....—95
State St. .....—87
Clark St. about....—90
Clark St. Am. Trust & Sav. Bldg..... ..... —89.6 & —87.2
LaSalle St. about...—90
LaSalle St. Corn Ex Bank. —85.2 & —90.11
Market St. .....—92
N. Central Park Ave.—32
Forty-first Ave. 0
Forty-third Ave. ... 8
Forty-fourth Ave. .. 7

ARBOR PL.

Union Park Ct.....—67

ARCHER AVE.

Commonwealth Edison ....—45.0 E. Shaft .....—49.0 West
Halsted St. .....—34
Throop St. & C. & A. tracks .....—33
S. Branch, E. dock.—43.0

ARMITAGE AVE.

N. Kedzie Ave.....+12
N. Sawyer Ave.... +9.6
Central Park ..... +9.0

AUGUSTA ST.

Paulina St. .....—52.7
Met. El. R. R.....—49.4
N. 47th Ave.....+15

AUSTIN AVE.

N. Rockwell St. & C., M. & St. P...+10

BELDEN AVE.

Spaulding near Belden ..... +5.5
Central Ave. .....+20

BELMONT AVE.

N. Brneh. of River.—30

BLOOMINGDALE AVE.

Diekson Ave. .....—71
Ashland Ave. C., M. & St. P. R. R....—73.0
Ashland Ave. .....—73
N. Winchester Ave.—63
N. Western Ave....—56
Kimball Ave. .....—16

BRIGHAM ST.

Ashland Ave. .....—48
N. Wood St. & Milwankee Ave. ....—49

CARROL ST.

Feet

N. Elizabeth St...—107

CASTELLO AVE.

Central Park Ave... +5

CEDAR ST.

State St. .....—105.0

CHELTHENHAM PL.

In lake going out to one mile from —13, —11, —22, —25, —25, —29 & —6

CHICAGO AVE.

N. branch of River.—82
The River .....—81 67
Halsted St. Bridge south pier .....—61
Morgan St. .....—61.0
Robey St. .....—14.0
Hoyne Ave. ..... +7.0
Campbell Ave. ....+23.0
Drake St. .....+10.8
Central Pk. Ave....+15.0
Monticello Ave. ...+15.2
Lawndale Ave. ....+18.7
Avers Ave. .....+20.
Harding Ave. ....+15.
Harding & 40th Aves. between .....+18.7
N. 40th Ave.....+10
N. 44th Ave.....+13.0
N. 47th Ave.....+12
N. 47th Ave.....+15
N. 48th Ave.....+19.0

CHICAGO TERRACE.

N. 40th Ave.....+15

COB AVE.

S. 46th Ave.....—35

CONGRESS ST.

State St. .....—81
Clinton St. .....—90
Halsted St. .....—71.0
S. Sacremento Blvd. —1

CORNELIA ST.

N. Marshfield St...—69
N. 49th Ave.....+11

DARWIN TERRACE.

Humboldt Blvd. ..+11
Humboldt Blvd. ...+11.2

DICKENS AVE.

N. Kedzie Ave....+12
Kimball Ave. .....+12.0
Central Park ....+12
N. Central Pk. Ave.+11.0
Springfield Ave. ...+12.0

DIVERSEY AVE.

Feet

Sedgwick St. .....—25.0
North Braneh .....—37.0
Water pipe Tunnel .....—58.1 W. side

DIVISION ST.

Sedgwick St. .....—84.0
C. N. W. Ry.....—69.0
Bliss St. .....—58
Hickory Ave. ....—54
Noble & Currier St. between .....—54
Lawndale Ave. ....+18.0

EDGEWOOD AVE.

Humboldt Blvd. ..+13

EIGHTEENTH ST.

Tunnel under south branch —47.0 both sides
Bridges East .....—35.0 and west ....—45 0
River .....—55
Loomis .....—43.0
Western Ave. .....—38.0
Campbell Ave. 150 ft. S. of S. line of 18th St.....—41.5
Campbell Ave. 200 ft. S. of S. line of 18th St.....—40.3

EIGHTY-FIRST ST.

In Lake going out to one mile off.. —22.6, —17, —10, —20, —24, —13.8 —8, —6, —13, —23.6, —23.6.
Ontario Ave. ....—10.0
Coles Ave. ..... —5
Commercial Ave. .. 0
Muskegon Ave. ....—10
Sherman Ave. .... —5
Manistee Ave. ....—10

EIGHTY-THIRD ST.

In Lake going out to ¾ miles off.. —20, —22, —24, —22.6
Buffalo Ave. .....—15
Ontario Ave. .....—10
Bond Ave. ..... —5
Coles Ave. 0
Commercial Ave. .. 0
Sherman Ave. ....—10.0
Western Ave. .....—20.0

EIGHTY-SIXTH ST.

½ mile off.....—14

ELDRIDGE PLACE

Michigan Ave. ....—82
State St. .....—74

EMILY ST.

Feet

Wood St. .....—52.3

ERIE ST.

Morgan St. .....—63
N. 48th Ave. .....+17.5

EWING PLACE.

Hoyne Ave. .....—58

FIFTEENTH ST.

Wabash No. 1532 Probably old No.—68
Blue Island Ave...—41.0
Blue Island Ave...—43
S. Central Ave....—20

FIFTY-FIRST ST.

¾ of a mile in lake—18.3
Foot of..—5 feet in lake
Going out in lake..—20
St. Lawrence Ave..—20.0

FIFTY-FOURTH ST.

Ft. of .....—11

FIFTY-FOURTH PL.

(Extended.)
In lake .....—10.6

FIFTY-SIXTH ST.

2¼ miles and coming in —27, —27, —31, —31, —26, —25, —26, —27.3, —29, —24, —28, —26, —28.3.
In lake .....—11
South of 56th St..—10.6

FILLMORE ST.

S. Central Pk. Ave.—36

FORQUER ST.

Blue Island Ave...—65.0

FORTIETH ST.

Stewart Ave. .....—37
Lowe Ave. .....—17
Emerald Ave. ....—33
Western Ave. .....—35

FORTY-FIRST ST.

Langley Ave. .....—68
In lake between 40th & 41st Sts. —15, —12, —15, —12

FORTY-SECOND ST.

In lake 5 blocks off .....—25, —23 & 13

FORTY-SECOND PL.

In lake off.—13 & —19

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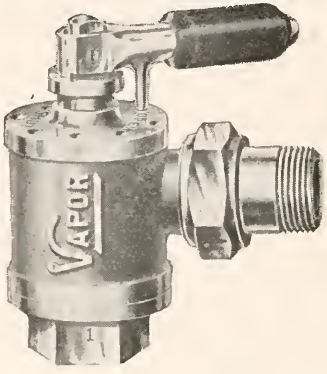

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FORTY-THIRD ST.

Feet
Lake Ave. .....—43.0

FORTY-FOURTH ST.

State St. .....—58.0

FORTY-SIXTH ST.

150 ft. east of shore—11.0
C. St. L. & P. R. R.—38.0
S. Leavitt St.....—38

FORTY-SEVENTH ST.

In Lake 2¼ miles from foot of 47th St. and proceeding to shore..... —25, —20, —19, —20, —25, —20, —25, —24, —25, —25, —9, —19 & —16.

FORTY-NINTH ST.

600 ft. east of shore —9.0
In lake off..... —9

FOURTEENTH ST.

Michigan Ave. ....—82
Centre Ave. .....—42
Fifty-Second Ave. .—29

FRONT ST.

Halsted St. S. Brch. Chgo river .....—40.0

FULLERTON AVE.

Clark St. .....—57.5
Sedgwick St. .....—57.0
Cleveland .....—50
Larrabee St. .....—25
Larrabee & Cleveland between ...—25
Halsted St. .....—28.0
N. Branch .....—19.0
Triangle at Cooper—65
River 100 ft. north of Fullerton Ave. bridge in the river—21
River 800 ft north of Fullerton Ave. bridge in the river—17
River 500 ft. north of Fullerton Ave. bridge in the river—18
Humboldt Blvd. ... +9
Humboldt Blvd.... +7
Kedzie Ave. ..... +9.0
Springfield Ave. .. —4.0

FULTON ST.

Canal nw. corner..—102
Canal se. corner...—87
Peoria St. .....—99.0
Oakley Ave. .....—55
Rockwell .....—45

GARFIELD AVE.

Clybourn Ave. north of C.M.&St.P. RR.—98
Clybourn Ave. south ofC.M.&St.P. RR.. station .....—107

GRANT PLACE.

Sedgwick St. .....—82

GRAND AVE.

River near (Boulders) .....—80
Desplaines St. ....—107

GRACE ST.

Western Ave. .....—41

HARRISON ST.

Feet
State se. corner....—58
State St. .....—84.0
Federal St. (Exchange)..—77 to —82
Fifth Ave. .....—82
Fifth Ave. .....—84
Bridges east ....—79.1
West .....—81.1
Springfield Ave. ..—36.0
44th Ave. & Colorado Ave. .....—38

HARVARD ST.

Homan Ave.—56.0 & 60.0
Central Pk. Ave...—51

HIRSCH ST.

Rockwell St. .....—43.5
Washtenaw Ave. ..—46.9
California Ave. ...—51.7

HOMER ST.

Rockwell .....—31

HARMON CT.

Michigan Ave. 4 mile tunnel ....—72
Wabash Ave. nw. corner .....—77
Wabash Ave. nw. cor ner .....—73.5
Wabash Ave. ....—72.11 & 74.11

HURON ST.

Campbell & Rockwell between ...+20
Lawndale Ave. between Ohio & Huron Sts. .....+15
Lawndale Ave. ....+20
Central Pk. Ave...+15
Central Park Ave. south of Huron..+10
40th Ave. .....+20
48th Ave. ..... +9

INDIANA ST.

LaSalle Ave. .....—79.0
Orleans St. .....—10.6
Kingsbury St. .....—80.0
Kingsbury St. (sta.) ..... —122
Lawndale Ave. ....+15
Hamlin Ave. .....+18
Avers Ave. .....+19
Springfield Ave. ..+19
40th Ave. .....+10

IOWA ST.

Central Pk. Ave...+10
Monticello Ave. ...+10
Read Ct. ..... +5

IRVING PARK BLVD.

Campbell Ave. ....—48

JACKSON BLVD.

Michigan Ave. ...—85
Fifth Ave. .....—83
Franklin St. .....—89
Franklin St. .....—89.0
Franklin St. se. corner .....—85
Franklin St. ne. cor at nw. RR. office .....—88.45 & —89.8
Clinton St. .....—96
Peoria St. .....—74
Western Ave. .....—57
Homan Ave. .....—50
44th Ave. .....—13
45th Ct. .....—13

JOHNSTON AVE.

Feet
Humboldt Blvd. ..+10.2

KINZIE ST.

State St. .....—114
Centre Ave. .....—70
Ann St. .....—78
Campbell Ave. RR. bridge north.....—35.0
South .....—45.0
40th Ave. ..... +3

LAKE ST.

River .....—98
Halstead St. .....—69.0
Ashland Ave. .....—63

LYDIA ST.

Union St. .....—93

NORTH BRANCH ST.

Larrabee St. at So. side of N. Branch St. .....—86
Larrabee St. n. side of N. Branch....—85

LAWRENCE AVE.

River .....—21.0

MADISON ST.

Michigan & Wabash between .....—110
State St. .....—84.0
Market St. Hearst Bldg. ..—91.3 & —97.3
River .....—91.5
Canal St. .....—100
Canal St. sw. cor. new N. W. R.R. Station .....—96.2
nw. cor. .....—105.8
Green St. .....—88
Centre .....—89
Campbell .....—53
Washtenaw St. ....—51
California Ave. ....—36
California Ave. ....—36.0
Douglas Blvd. ....—11.0

MICHIGAN ST.

State St. .....—97

MAXWELL ST.

Blue Island Ave...—45

McLEAN AVE.

California Ave. ...—34
Central Pk. Ave. .. +9

MEDILL AVE.

Central Pk. Ave.. +5

MONROE ST.

Michigan Ave. C. A. A. .....—103
State St. .....—95
LaSalle St. Harris Trust Bldg. ....—87.6 & 94.4
LaSalle St. about ..—90
LaSalle St. nw. cor. .....—89.6 & 83.6
LaSalle St. .....—92.0
LaSalle St. se. cor. 90.10, —92.8 & —51.0
Market St., Farwell Bldg....—83.5 & —89.5
Jefferson St. .....—98
Halsted St. .....—70.0
Halsted St. .....—70
Sacremento Blvd. ..—35
Kedzie Ave. .....—40
Spaulding Ave. ....—52

Feet
Homan Ave. .....—40
St. Louis Ave.....—40
40th Ave. ..... —6

NELSON ST.

Western Ave. .....—40

NINETEENTH ST.

Wentworth Ave. ..—68
Washtenaw Ave....—56.4
Washtenaw Ave. 90 ft. N. of S. line of 19th St.....—54.0

NINETY-FIRST ST.

Under Grand Calumet River..... ....—66.0 east & west
Kingston Ave. ....—10
Essex Ave. ..... —5
Phillips Ave. east side 0
Phillips Ave. west side of ..... +5
Yates Ave. .....+10.0
Stoney Island Ave. .. 0

NINETY-SECOND ST.

Stoney Island Ave.. —5

NINETY-SECOND PLACE.

Stoney Island Ave.. +8

NINETY-THIRD ST.

Cottage Grove Ave..—55

NINETY-EIGHTH ST.

St. Lawrence Ave. —42.0

NORTH AVE.

Halsted St. .....—80.0
Clybourn Ave. ...—80
Hawthorne Ave. ...—77
Cherry Ave. Bridge near North Ave. —68
C. & N. W. Ry....—70.0

OAK ST.

Ashland Ave. ....—64
Marshfield St. ....—63

OGDEN AVE.

48th Ave. ..... —8

OHIO ST.

Washtenaw Ave. ..+15
California on C. M. & St. P. .....+10
Wright Ct. .....+15
Hamlin Ave. .....—20
40th Ave. .....—15
49th Ave. .....—15.3

ONE HUNDRED & SECOND ST.

State St. .....—45

ONE HUNDRED & FOURTH ST.

Stewart Ave. .....—35

ONE HUNDRED & SEVENTH ST.

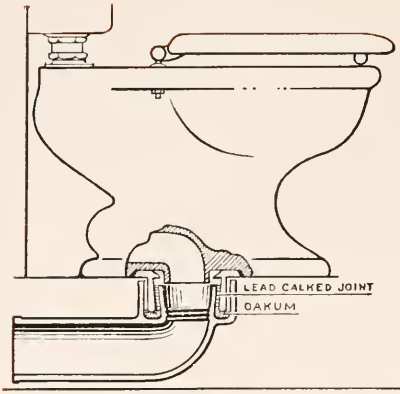
Oakley Ave. .....—10.0

ONE HUNDRED EIGHTH PLACE (Extended).

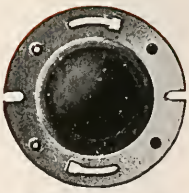
Manistee Ave. (extended) .....—65

ONE HUNDRED ELEVENTH ST.

C. & E. I. R.R....—10.0



Reliance Closet Connections



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Finished floor can be laid to the opening, making a perfect bond.

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Made for cast iron soil and threaded for wrought iron pipe.

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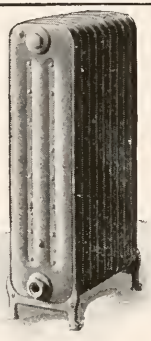

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The maximum of efficiency—in the smallest space and with the most refined appearance.

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ONE HUNDRED TWENTY-SEVENTH ST.

Feet
C. E. I. R. R.....—65.0

ONTARIO ST.

Orleans St. .....—98
48th Ave. .....—14.8

PALMER AVE.

Humboldt Blvd. ..+10
Humboldt Blvd. .. +8

PARK AVE.

Wood St. .....—60

PECK CT.

Wabash Ave. .....—80

PETERSON ST.

Hoyne Ave. .....—51

POLK ST.

Federal St. .....—82
Bridge East —80.2 & west .....—77.8
Rockwell .....—38
Springfield Ave. ..—41

QUINCY ST.

State north of Quincy .....—63
Market St. .....—86

RANDOLPH ST.

Wabash Ave. about.—90
Bridge east.....—75.9
Jefferson St. .....—86
Beaubien Ct. .....—86

READ CT.

Middle of Read Ct. +5

RICE ST.

Western Ave. ....+10
Oakley Ave. .....+10
Kedzie Ave. & Bloomingdale ... —2.0

SEVENTEENTH ST.

Robey St. 145 ft. N. of N. line of 17th St. ..... —5.1
Robey St. 640 ft. N. of N. line of 17th St. .....—28.5

SEVENTIETH ST.

In lake off.....—12

SEVENTY-FIRST ST.

Coles Ave. .....—55
Oglesby Ave. .....—59.0
Lake Shore .....—56.0

SEVENTY-SECOND ST.

Coles Ave. .....—47
Oglesby Ave. .....—52.0

SEVENTY-THIRD ST.

Crib, Edw. Dunne.—101
In Lake off.....—13.6
Bond Ave. .....—52
Coles Ave. .....—56.2
Oglesby Ave. .....—48.0
Constance Ave. ....—45
Ellis Ave. .....—31
Drexel Ave. .....—49
State St. .....—51

SEVENTY-FOURTH PL.

Railroad Ave. ..... +5

SEVENTY-FIFTH ST.

Feet
Saginaw Ave. 0
Yates Ave. ..... —0.0

SEVENTY-SIXTH ST.

In Lake off.....—13
Saginaw Ave. 0
Colfax Ave. 0

SEVENTY-SIXTH PL.

Sherman Ave. 0

SEVENTY-EIGHTH ST.

In Lake off.....—17.6
In Lake off.....—22

SEVENTY-NINTH ST.

In Lake going out one mile off.... —16, —20, —20, —22, —22, —23.6, —20, —22, and —25.
Ontario Ave. ..... +1.5
Escanaba Ave. .... —4.0
Muskegon Ave. .... —3.0
State St. .....—36

SIXTEENTH ST.

State .....—54.0
Dearborn St. .....—73
Clark St. .....—52
Grove St. S. Branch Chicago River...—25.0
Union St. 100 ft. N. of N. line of 16th St. 35.9
Union St. 200 ft. N. of N. line of 16th St. .....—38.4
Halsted St. 0 ft. N. of N. line of 16th St. .....—34.7
Halsted St. 200 ft. N. of N. line of 16th St. .....—39.1
Newberry Ave. 0 ft. N. of N. line of 16th St. .....—33 0
Newberry Ave. 200 ft. N. of N. line of 16th St.....—38.0
Johnson St. 0 ft. N. of N. line of 16th St. .....—34.0
Peoria St. 200 ft. N. of N. line of 16th St. .....—44.7
Sangamon St. 0 ft. N. of N. line of 16th St. .....—30.9
Sangamon St. 200 ft. N. of N. line of 16th St.....—43.4
Morgan St. 0 ft. N. of N. line of 16th St. .....—41.5
Morgan St. 200 ft. N. of N. line of 16th St. .....—44.9
Center Ave. 0 ft. N. of N. line of 16th St. .....—57.0
Center Ave. 150 ft. N. of N. line of 16th St. .....—50.0
Blue Island Ave. 0 ft. N. of N. line of 16th St..—47.2
Blue Island Ave. 150 ft. N. of N. line of 16th St..—38.8

Feet
Throop St. .....—89
Loomis St. 0 ft. N. of N. line of 16th St. .....—29.1
Loomis St. 140 ft. N. of N. line of 16th St. .....—28.0
Laflin St. 0 ft. N. of N. line of 16th St. .....—22.0
Laflin St. 140 ft. N. of N. line of 16th St. .....—25.7
Ashland Ave. 0 ft. N. of N. line of 16th St. ..... —4.2
Ashland Ave. 140 ft. N. of N. line of 16th St. ..... —8.0
Paulina St. 0 ft. N. of N. line of 16th St. .....—18.0
Paulina St. 145 ft. N. of N. line of 16th St. .....—16.1
Wood St. 0 ft. N. of N. line of 16th St. .....—17.5
Wood St. 145 ft. N. of N. line of 16th St. .....—16.2
Lincoln St. 0 ft. N. of N. line of 16th St. ..... —4.0
Lincoln St. 200 ft. N. of N. line of 16th St. .....—14.6
Forty-fourth Ave...—37.0

SIXTIETH ST.

Stony Island Ave...—75

SIXTY-THIRD ST.

Stony Isl. Ave. east.—79.0

SIXTY-SIXTH ST.

In Lake south of...—11

SIXTY-SEVENTH ST.

Langley Ave. .....—95.0

SIXTY-EIGHTH ST.

Crib Borings:
5000 ft. from shore.—60.0
5800 " " " —60.2
8400 " " " —64.6
10300 " " " —69.4
11100 " " " —103.0
Oglesby Ave. .....—60.0

SOUTH WATER ST.

Wabash Ave. .....—114.0
State St. Bridge:
South .....—69.0
North .....—71.9
Dearborn St. Bridge:
East .....—95.0
West .....—105.0
Dearborn St. River.—102
Dearborn St. River.—102.6

SUPERIOR ST.

Rockwell .....—10
48th Ave. .....—11.8
49th Ave. .....—16

TAYLOR ST.

Clark St. .....—68
Federal St. .....—80
Springfield Ave. ...—43

THIRTY-FIRST ST.

Feet
Cottage Grove Ave..—55.0
C. R. I & R. R. R..—27.0
Stewart Ave. .....—27
Lowe Ave. .....—11
Morgan St. ..... —3
Benson St. .....—32
Ashland Ave. Chicago River near 31st St. .....—33
S. Fork of S. Brnch.—32.0

THIRTY-SECOND ST.

48th Ave. .....+15

THIRTY-THIRD ST.

Halsted St. .....—26
Lowe Ave. .....—22
Auburn St. .....—20

THIRTY-FIFTH ST.

At Pier off..... +2
Vernon Ave. .....—50
Michigan Ave. .....—37.1
Canal St. .....—37
Halsted St. .....—25.7
Centre St. .....—28
Western Ave. .....—12.0
48th Ave. .....—75
Under S. Fork of S. Branch:
East Side .....—27.0
West Side .....—28.0

THIRTY-SIXTH ST.

Union Ave. .....—27
Western Ave. ..... —7.0

THIRTY-SIXTH PL.

Michigan Ave. ....—41

THIRTY-SEVENTH ST.

State St. .....—92
Wentworth Ave. ...—42
Stewart Ave. .....—21
Union Ave. .....—23
Morgan St. .....—25

THIRTY-SEVENTH PL.

Halsted St. .....—27

THIRTY-EIGHTH PL.

At Lake .....—58

THIRTY-NINTH ST.

Wabash Ave. .....—30
Wabash Ave. .....—28
State St. .....—30.0
Dearborn St. .....—31
Wentworth Ave. ...—18.5
Stewart Ave. south of .....—34.5
Stewart Ave. .....—24.5
P. F. T. W. & Cr. R.—25 0
Union Ave. .....—24
Emerald Ave. .....—30
Emerald Ave. .....—29.7
Halsted St. .....—21
Ashland Blvd. .....—28
Western Ave. .....—35.0
Centre Ave. and River (Slip) .....—22.0

THOMAS ST.

Lincoln St. .....—48.7
Western Ave. ..... +5
Lawndale Ave. ....+10

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Also manufacturer of **F. D. Renaud Duplex Cement Flashing Block.** U. S. Patent issued Sept. 24, 1912. Canadian, March 18, 1913.

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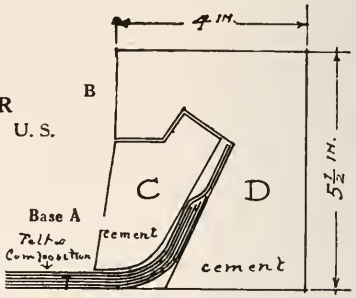
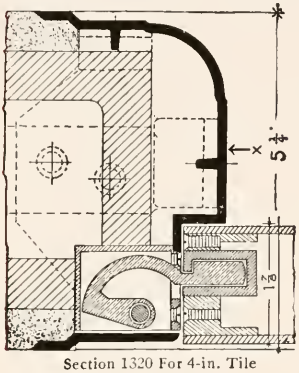


Duplex Flashing Block



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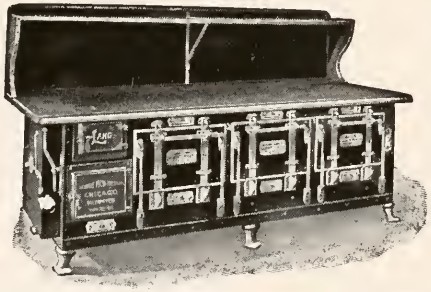

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Furnished by us for three State Capitols

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HARDWICK, VT.

TWELFTH ST.

Feet

Wabash Ave. No. 1223 .....—71
Wabash Ave. .....—71.0
Wabash Ave. .....—70.0
Wabash Ave. .....—71
Fifth Ave. Bridge..—58.0
Union St. .....—66.0
Waller Ct. .....—34
Blue Island Ave....—52
Campbell Ave. ....—60
Rockwell St. .....—52.0
Rockwell east of...—55
Rockwell west of...—55
46th Ave. .....—36.0
48th Ave. .....—64.0

TWENTIETH ST.

Wentworth Ave. ...—53
Canal St. Bridge:
North .....—68.2
South .....—67.4
Ashland Ave. .....—39

TWENTIETH PL.

Lincoln Ave. ..... +5

TWENTY-FIRST ST.

Western Ave. .....—31.0
Campbell Ave. ....—30.0

TWENTY-SECOND ST.

Michigan Ave. .....—94.0
Fifth Ave. No. 2241.—49
Chicago River .....—67
Bridges .....—62.5
Poplar Ave. ..... +5
Fisk .....—30
Centre Ave. .....—60.0
Ashland Ave. .....—29.0
Ashland Ave. .....—52.0
Campbell Ave. ....—20.0

TWENTY-SECOND PL.

Stewart Ave. .....—64

TWENTY-THIRD ST.

C. R. I. & P. R. R.—64.0
Wood St. .....—37
Campbell Ave. .... —9.0

TWENTY-FOURTH ST.

Campbell Ave. .... —9.0

TWENTY-FOURTH PL.

Wallace St. .....—25

TWENTY-FIFTH ST.

Lake Park .....—49
State St. .....—16.8
Throop St. Bridge:
North .....—52.0
South .....—46.5
Ashland Ave. and Levee St. .....—49.5
Ashland Ave Bridge South .....—46.4
Campbell Ave. .... —9.0

TWENTY-FIFTH PL.

Emerald Ave. .....—24

TWENTY-SIXTH ST.

Feet

Indiana Ave. .....—26
Ashland Ave. South Brnch. of River at North Pier of S. Ashl'd Av. Bridge.—40
Ashland Ave. at S. Pier, S. Brnch. of River Bridge.....—40
Western Ave. S. line 26th St. ..... —8.0
Western Ave. West Fork of S. Brnch. of River, North —7.0 & S. End... 18.0
Western Ave. over Chicago River ...—12.0
Western Ave. West Fork ..... —8.0
Western Ave. South Brnch. of River..—80
Rockwell St. (extended) S. Brnch. of River at the Bend .....—20
Rockwell St. E. of.—17.6

TWENTY-NINTH ST.

Halsted St. ..... +5
Washtenaw Ave. ...—20

VAN BUREN ST.

Michigan Ave. ...—107
Plymouth Ct. bet. Van B. & H. Sts., Edison Bldg.... .....—83.0 & —87.0
Dearborn St. .....—89.0
Dearborn St. N. of Van Buren ....—82.0 & 89.0
Fifth Ave. No. 373.—78
Franklin St. .....—81
Market 200′ of Van B. along River... .....—82.8 & 87.9
Oakley Blvd. .....—70
Washtenaw .....—52

WARREN AVE.

Talmen Ave. .....—50
Francisco Ave. ....—37
Albany Ave. .....—41
St. Louis Ave. at extension .....—57

WASHINGTON ST.

State St. about.....—90
State W. side of on alley bet. Washington & Madison Sts. .....—93
Dearborn St. & Clark St. the Title & Trust Bldg. east of.....—89.6 & 94.10
Fifth Ave. & Franklin Sts. between. .....—95 to 102
Market St. Edison Bldg....—94.0 & 97.2
Hermitage Ave.....—60
Robey St. .....—65
Western Ave.....—54
Blue Island Ave....—52.0

WILCOX AVE.

41st Ave. ..... —2

WOODLAWN PARK.

Fee

At the Lake.....—39.7

MISCELLANEOUS.

Intermediate Crib at Lake off 73d St..—76

Jackson Park Long Pier 1/3 mile from Shore .....—60

Jackson Pk. in Lake off Long Pier....—11.6

Field Museum ....—63 to —66

Jackson Park Lake off German Bldg.—10

Hyde Park Tunnel & going in at the Tunnel .....—56

Hyde Park Tunnel..—66
Calumet River at 111th St. .....—18

Under W. Fork I. & M. Canal & Feed S. Ashland Ave.. —46.6 north, —41 south

Under I. M. Canal S. Western Ave.. .....—44.0 both sides

S.-W. Land & Lake Tunnel (Borings & Tunnelings)— Section 2:

State St. .....—42.0
St. Lawrence Ave. —54.0
Cottage Grove Ave.—56.0
Woodlawn Ave. ..—53.0
Washington Ave. ..—54.0
Cregier Ave. .....—45.0
Jeffrey Ave. .....—34.0
Paxton Ave. .....—36.0
Yates Ave. .....—45.0
Bond Ave. .....—58.0

S.-W. Land & Lake Tunnel (Borings & Tunnelings)— Section 1:

104th St. at Wentworth Ave. .....—38.0
99th St. at State St.—44.0
87th St. at State St. —34.0
79th St. at State St. —46.0

S.-W. Land & Lake Tunnel (Borings & Tunnelings)— Section 3:

4500 ft. E. of shore—59.6
7500 ft. E. of shore—60.2
10500 ft. E. of shore—66.0
12000 ft. E. of shore—88.0
13000 ft. E. of shore—103.0

Sanitary Canal at S. Western Ave. ...—44.0 East & West.

Milwaukee & Clinton N. W. R.R..... .....106.11 & 108.11

Lake View Tunnel Borings Shore Shaft—

1500 ft. E. in lake—69.0
3000 ft. E. in lake—64.0
4500 ft. E. in lake—60.0
6000 ft. E. in lake—55.0
7500 ft. E. in lake—57.0
9000 ft. E. in lake—61.4
10000 ft. E. in lake—63.0

Feet

Four Mile Tunnel at Michigan Ave. & I. C. .....—78

Humboldt Park Center of .....—48.0

Calumet River Brdg at old N. Channel between 111th & 114th St. .....—14

Sixty-eighth Ave. at Oak Park .....—33

Wis. Cen. R.R. and Central Pk. Ave..—36

Park Row and 2½ Mile Crub (Boring)—

Shore Shaft:

2500 ft. from shore—77.0
5000 ft. from shore .....—85.0 & —90.0
7500 ft. from shore—96.0
10000 ft. from shore—100.0
12800 ft. from shore—107.0

E. Side of Goose Island at N. Pier of Halsted St.

Bridge near E. Side of Goose Island..—60

E. Side of Goose Island at N. Pier of Halsted St. Bridge—60

Court House and City Hall ....—97.0 to —103 0

Fisk St. Commonwealth Edison ..—48.0 north shaft.

Humboldt Blvd. at Caltalpia Ave. ..+75

Humboldt Blvd. and N. Branch .....—37.0

Humboldt Ave. at Humboldt Blvd...+10

Ashland Ave. W. Arm S Fork S. Branch Exeav. did not reach rock.

Sheridan Rd. at the Canal .....—59.8

Millard Ave. at Colorado Ave. 3%

E. North Water St..—94

W. Western Ave. Humboldt Blvd. (N. Sacremento) —25

Montrose Ave. & N. Branch —37.2 west & 38.5 east.

Windsor Ave. at Elliot Ave. .....—31

Austin Ave. & N. Morgan St. .....—77

Center Ave. & Sedgwick St. .....—82 0

N. Branch & N. Western Ave. ...—36.0 north and —45.0 south

Ogden Ave. at Clyde Ave. .....—37

Kinzie St. at Cuyler Ave. .....—40

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For the general application of varnish it would be quite useless to formulate any set of rules. The experienced mechanic knows well the variability of this material and his experience enables him to obtain results which are in the main satisfactory. There is perhaps no other building material which is subject to such variations in results obtained: climate, the state of the weather and the season of the year all have their influence. What would be satisfactory in Oregon, for instance, might be condemned as poor in Florida. Again, a varnish suitable for the New England coast might cause perplexity in Texas. Varnish must be handled in different ways to give satisfaction in different climates.

Varnish "deviltries" are well known to the practical man and often are the result of local conditions. If a building is insufficiently heated or is very damp, the varnish will not flow out smoothly nor dry properly. A temperature of 72° is the proper one.

Brittleness, glazing and **cracking** are closely related and often caused by identical conditions: as, for instance, extreme cold, or the undercoat not being thoroughly dry, or too elastic for the finishing coat, and last, but not least, a cheap, inferior grade of varnish.

Deadening is caused by improper filling of sappy wood, by applying the finishing coat before the undercoat is thoroughly hard, or by an insufficient undercoat.

Blistering is caused by exposure to the direct rays of the sun, or to sap or moisture in the wood. Excessive heat, too, will produce this at times.

Temperature—Varnish that has been kept in a cold place should not be applied, as it is very likely to be too heavy, and hence will not flow out smoothly nor dry properly. It should be kept in a temperature of about 72°.

Blooming is caused by excessive moisture in the atmosphere after the varnish has hardened in the proper temperature. It may be removed by washing lightly with kerosene followed by a gentle rubbing with a soft woolen cloth. Cheap varnishes are very subject to this trouble.

Knots and Sappy Wood should have a first coat of shellac; otherwise a good surface cannot be obtained.

Varnish as it is sold by the manufacturer is of the proper consistency for spreading and should not be thinned unless it has become heavy, in which case use naphtha or pure spirits of turpentine. Avoid turpentine substitutes—they are usually frauds. The varnish and thinner should be of the same temperature and after being mixed should stand a little while to insure perfect amalgamation.

Another very important feature in the use of architectural varnishes is the condition of the building when the finishing coats are applied. Many a fine job has been ruined by the state of the atmosphere arising from the use of mortar in the walls or in laying tile. While the mortar is soft no varnishing should be done. After it has hardened the room must be thoroughly aired and the temperature brought up to 72°.

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VALUES OF PAINTS IN PROTECTING METALS

POWERFUL INFLUENCE OF BASIC PIGMENTS IN PROTECTING METALS FROM CORROSION AS SHOWN BY EXPOSURE TESTS LASTING FIVE YEARS

By Henry A. Gardner Assistant Director, The Institute of Industrial Research, Washington, D. C.

(Copyright, 1914, by H. A. Gardner.)

Editor's Note.—The fundamental reasons why some paints are better for painting metal roofs, sheets and the like are set forth in the accompanying article. Many inquiries come to this journal for information on the best paints for use on sheet metal and accordingly the data set forth herein should prove most valuable to many readers.

In a recent article on the subject of metal paints ("Primers for Metals," Bulletin 37, scientific section, Paint Manufacturers' Association of the United States) the author called attention to the remarkable rust-preventing properties of litharge, a pigment which gave even more pronounced inhibitive results than the chromate pigments when placed in water in contact with iron plates.

The power of litharge to keep iron absolutely free from rust was attributed to the highly basic nature of the pigment, basic substances when present in sufficient concentration being well recognized as powerful inhibitors of corrosion. Attention was called, however, to the impracticability of litharge as the pigment base for an oil paint on account of the rapid mass hardening that occurs when litharge is mixed with linseed oil. The cause of such hardening phenomena is easy to understand when the readily saponifiable nature of the drying oils is taken into account. The product of reaction between litharge and linseed oil is lead linoleate, a powerful paint drier, which has remarkable oxygen-carrying properties.

The author, in the article previously referred to, in commenting on the litharge content of red lead, brought out several points which are pertinent to the present discussion, as follows:

Litharge Content of Red Lead.

"Although red lead is chemically termed the tetroxide of lead, a combination of litharge (the yellow monoxide) and storage-battery lead (the brown dioxide), there is often formed, according to the process used, a product which contains varying percentages of free litharge or uncombined oxide. It is this percentage of litharge which makes some red leads more likely to body and harden in oil after long standing than other types of red lead.

"Orange mineral, a type of red lead made by roasting white lead, is practically pure-lead tetroxide and for this reason red-lead paints made from orange mineral do not body or harden and may be kept for months in a smooth condition. On account of this fact red-lead manufacturers have endeavored to produce red leads with a minimum litharge content by the old method of roasting pig lead, and some manufacturers have marketed a product which contains as high as 98 per cent of pure red lead and less than 2 per cent of litharge.

"Although such red lead is preferable for making red-lead paints which are to be packed for some time before use, it is not as highly inhibitive in its protective effect as those red leads containing high percentages of litharge.

"One feature of this question, however, which has not received sufficient investigation is that relating to the physical structure of the pigment particles. The author is of the belief that a pigment containing as high as 15 per cent of litharge would be free from the objection of excessive action upon oil if the pigment particles were of the correct physical structure. Such a pigment would undoubtedly be preferable on account of its increased inhibitive properties."

It is of interest to record that paint pigments referred to are those which contain a very high percentage of litharge in such physicial condition as to be practically free from action upon linseed oil and yet possessed of the normal inhibitive character to be expected of the litharge content. The pigments referred to are those which are produced by the sublimation of lead and zinc ores, among which may be mentioned basic sulphate-white lead and sublimed-blue lead. The latter material consists approximately of 65 parts of lead sulphate and 35 parts of lead oxide, the components being chemically and physically combined in the form of an amorphous pigment substance of great fineness. The presence of small percentages of carbon and lead sulphide as natural impurities gives to this pigment a pleasing steel-gray color.

Although the high percentage of litharge in this product, if uncombined, would be sufficient to cause the immediate hardening of a linseed-oil paint made therefrom, experiments have shown that this pigment is practically free from reaction with saponifiable oils. That this pigment is highly inhibitive and most durable when mixed with linseed oil and spread upon iron plates has been demonstrated in exposure tests placed by the author, at Atlantic City five years ago under the supervision of the American Society for Testing Materials.

Factor Affecting Inhibitive Value.

That the degree of basicity of any pigment is to a large extent responsible for its good behavior when applied as an oil paint to a metal surface is further substantiated in the tests referred to. A lead-chromate pigment containing a considerable percentage of litharge in chemical combination with normal-lead chromate, was found to be the most highly inhibitive protective paint in the tests. After five years' exposure its rating is still practically 100 per cent, as recorded by the official inspectors.

A chromate pigment, to be inhibitive, must be either slightly water soluble or basic. Zinc chromate is a good example of a slightly water-soluble chromate pigment. In the presence of water it is subject to ionization, thus rendering available its chromic acid content, which has the effect of preventing the solution pressure of iron. Basic chromate of lead is a good example of a chromate pigment which is highly inhibitive on account of its basic nature. On account of the insoluble and neutral nature of normal lead chromate this material would not be expected to fulfil the requirements of an inhibitive chromate pigment.

Value of Zinc Oxide.

Zinc oxide is another basic pigment which has proved highly valuable as a constituent

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of metallic paint. In physical combination with lead sulphate (in about equal parts), as it occurs in zinc lead, this pigment has shown the pronounced inhibitive effects of pigment basicity. Zinc oxide fortunately is a pigment which of itself may be ground in linseed oil, of normal value, and show little tendency toward hardening. In this form, therefore, it is coming into use as an inhibitive base pigment to admix with iron-oxide roofing paints, to which it adds considerable merit. In a previous article this subject was discussed as follows:

"The greatly increased protection which was afforded the iron plates by the addition of zinc oxide is of practical interest to the painter, inasmuch as zinc oxide in oil is a common adjunct to every paintshop, and its addition to the widely used and popular iron oxide, or so-called metallic paints, is a simple matter. Such addition, moreover, produces a paint which has great spreading power and other desirable properties. It is also of interest to note the increased inhibitive effect that is obtained by the addition of zinc oxide to corroded white lead, mixtures which could be used for the production of white or shaded metallic paints. It may be pertinent to record at this point that such mixtures have proved more durable in field tests than either single pigment."

Value of "Pure" Paint.

In a recent article entitled "Paint Efficiency and Paint Purity," which appeared in the Iron Age of February 13, 1913, Mr. George Auchy states that the paint trade is discovering that "the purer the paint the poorer." Assuming that the word "pure" may be applied to such a substance as paint, there can be no question that Mr. Auchy's theory holds good in many instances. That the purity of a truly stimulative pigment has much to do with its rust-producing properties there is much evidence to show. Pure graphite, pure carbon black and pure lampblack, ground in oil and applied to steel plates in the Atlantic City tests, developed their rust-exciting tendencies in a very short time. Tests simultaneously made, with the same pigments admixed with large percentages of neutral inert pigments such as barium sulphate and silica, prove the value of these so-called paint extenders in nullifying the corrosive action of the black-carbon pigments and in strengthening their films.

That the theory "the purer the paint the poorer" would not always apply where a really inhibitive paint is concerned is the writer's belief. Paints made entirely of basic chromate of lead, pure sublimed blue lead or pure zinc chromate, ground in the proper amount of linseed oil, will outlast paints made of only a small percentage of the same pigments admixed with a large percentage of barium sulphate or china clay. However, there may be a critical point in the admixture of the inhibitive pigments with the inert pigments where added percentages of the inhibitive pigments cease to add proportionately to the value of the mixture. This point, however, has not been determined by practical tests with all of the pigments, although considerable laboratory investigations on the subject have been made.

Basicity as Shown by Tests.

At the end of a five years' test, depicting the condition of two grades of red lead, one of which has been given the trade name of orange mineral. The latter type of red lead is produced by the oxidation of off-color white lead or white-lead tailings. In its highly oxidized condition it is practically 100 per cent red lead (tetroxide of lead), with no appreciable percentage of litharge.

The manufacturer of red lead, however, has been striving to produce a product which will answer specifications which are often ill advised, the purchaser having the misconception that the purest red lead—one containing the highest percentage of lead tetroxide—would be the best.

In the endeavor to meet such specifications some manufacturers have made use of artificial oxidising agents, such as potassium nitrate, in conjunction with the furnacing of the pigment. The red lead resulting from such treatment, although containing often as high as 98 per cent lead tetroxide, is liable to contain a small percentage (0.1 to 0.5 per cent) of soda or nitrate salts. These may be extremely active in promoting rust.

(For formulae see page 307. Miscellaneous Information.)

Such red lead would be more generally available than one containing the higher percentage of lead tetroxide. The drying power of such red lead would be excellent, and if mixed with linseed oil just before application would prove a highly satisfactory paint. It is well to record at this point that those red leads which consist almost wholly of lead tetroxide are not good drying pigments. It is even necessary to add artificial driers to linseed-oil paints made from such pigments. Such paints, however, have the advantage of remaining soft even after standing in sealed packages for several months. This property of the high-percentage red leads has made them popular in the manufacture of ready-mixed pure red-lead paints.

The service to be expected from such paints however, would not be as great as the service attending the use of a prepared red-lead paint made from red lead containing litharge in considerable proportion, such, for instance, as that shown in the foregoing specifications, mixed with equal parts by weight of an inert pigment such as silica, china clay or asbestine. Paints made from such a mixture would be practically free from hardening in a package for a considerable period of time. They would, moreover, be less expensive than 100 per cent pure red-lead paints. In inhibitive power, spreading capacity, and brushing properties they would be superior to paints made from 100 per cent pure red lead.

Influence of Carbon Paints.

Carbon black and lampblack are very popular for use as surfaces for red-lead paints, and for such use they give excellent results. In this connection it might be well to state that excellent results may be expected from most pigments which are basic in nature, if applied properly to a metal plate and then surfaced with a paint containing a carbon pigment, such as lampblack, carbon black or graphite.

There are included in the Atlantic City tests several panels which were originally painted with three coats of ordinary whiting (calcium carbonate) ground in linseed oil. On the lower left-hand corner of these panels were placed numbers with lampblack paint. The basic nature of the calcium-carbonate pigment protected the metal from corrosion for a considerable period of time. The great chalking tendency, however, of the whiting caused the removal of the paint within eighteen months, except in those spots which had been coated with lampblack numbers. In such places perfect condition of the paint film is shown. This result further strengthens the writer's good opinion of basic pigments as primers of metal.

The question as to whether painting done over metals surfaced with mill scale would be as efficient as painting done over metals previously cleaned from mill scale through the use of the sandblast or by pickling has been discussed at length by various authorities. In some instances, such as in the case of a large steel-bridge structure, the cleaning of the metal before painting is often impracticable. Excellent results have been re-

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corded of painting done on such types of work, directly over the mill scale. For smaller work, however, wherever the removal of the mill scale is practicable, the expense of cleaning will be justified by the good results obtained. (For formulae see page 307, Miscellaneous Information.)

A pinhole in a sheet of tin plate may lead to the destruction of the plate. A pinhole in a paint film or a defect in the metal surface may lead to serious results if the pigment is not inhibitive. The admission of moisture through an abrasion in the film may be primarily responsible for the appearance of the surrounding paint film, with the formation of a cup which collected and retained sufficient water to start the formation of rust. The increasing rust expanded the size of the film cup, gradually filling it with a soft, porous, water-retaining mass of iron-oxide pigment.

If the pigments in a paint film are thoroughly inhibitive, pinholes or scratches do not constitute a serious menace. The moisture which deposits upon the abraded surface has little or no effect when in the presence of a thoroughly inhibitive pigment. This condition, however, might not hold true in certain cases. Some sheets of black metal have upon their surface a type of mill scale which is evidently not of a continuous nature. The electro-negative nature of the mill scale would tend to force into solution any exposed area of iron. Development of gaseous hydrogen beneath the paint film at such spots would account for the formation of blisters.

By-product tars from coke ovens, gas works and other sources have formed the base of a great many paints sold for the protection of metal. These paints make very good coverings for metal exposed to acid fumes within buildings, but do not have the property of withstanding exterior exposure. The action of the sun is most powerful in breaking them up.

It has been thought that greater durability might be expected of a paint if its linseed-oil content were replaced with varnish containing costly resins such as kauri and copal. As a matter of actual test, however, varnish paints for metal have never proved very satisfactory. The crazing of the varnish is responsible for the early decay of such paints.

Iron oxide might also be classed as a basic pigment. If of good quality, it gives very fair results on metal surfaces. When admixed with calcium sulphate in the form of venetian red, it is less satisfactory than when used in its purer state. Black precipitated oxide of iron is, on account of its highly basic nature, a pigment of great value in the manufacture of metal paints. Black paints made with this pigment have outlasted all the other black paints exposed at Atlantic City. Its use should rapidly increase, now that its merit is established. In fineness and hiding power it is superior to all other forms of iron oxide.

FIRE RETARDANT PAINTS FOR SHINGLES

During the past year certain ordinances have been proposed or passed by various municipalities in the middle south, restricting the use of wooden shingles and certain kinds of wooden trim in thickly populated centers. That the passage of such legislation may have been urged by producers of structural materials designed to replace the wooden shingle, has probably been the first thought of the lumber producers whose industry has been seriously threatened by such ordinances. It is at least improbable that such attempts to regulate the use of the wooden shingle are based upon reliable statistics which might demonstrate that the wooden shingle is responsible for a large percentage of the annual fire loss.

Regardless of the attempts which are being made to abolish the wooden shingle, it would appear to the writer that this popular form of roofing material will always be used to a considerable extent. Its moderate cost, light weight, low heat conductivity,* wide application, and durability, are properties which recommend its use upon dwellings, barns and other structures of this type. There is recorded evidence to show that the better grades of shingles have weathered in some instances for over a hundred years upon the roofs of dwellings, and have afforded during such time a high degree of resistance to the elements. In this connection, it is of interest to cite the durability of the shingle roof of General Washington's colonial mansion overlooking the Potomac at Mount Vernon, Va.** Originally covered with cypress shingle in 1743, the roof has since been patched but twice, at periods about sixty years apart. During the latter part of 1913 the roof was again mended. Although producers of some other types of roofing materials may claim that their products would have proved quite as durable, it is probable that they have no similar century-long service records to substantiate such claims. Moreover, it is likely that such manufacturers, when discussing the advantages of different kinds of roofing, emphasize the fire-refractory nature of their own products but refer to the wooden shingle as constituting the greatest fire menace of the day.

Very few structural materials have ever been made, which have proved satisfactory for roofing or other building purposes, without some surface treatment. If iron or steel sheets are exposed to the weather they will rapidly corrode and rust away to a mere lace-like skeleton of their original form. The application of suitable paint coatings at proper interals, will, however, preserve such metal sheets for an indefinite period of time. Nearly all forms of cement or stonework will check, crack, absorb large quantities of moisture, and become unpleasing in appearance, unless properly treated with protective paints. The weather boarding and wooden trim of all kinds of structures would soon rot and decay if left in an unpainted condition. It is evident that "paint is the preserver of all things structural" and that we must look to the use of paint for the solution of the problems under consideration.

*The writer conducted a series of laboratory tests to determine the heat deflecting properties of various types of roofing materials. Miniature houses were roofed with bare shingles, painted shingles, tin and stone. Thermometers were inserted in the end of each house. The houses were placed in an oven heated to 150 deg. C. At the end of 15 minutes, thermometric readings were taken. The interior of the houses roofed with stone and tin showed a much higher temperature than those roofed with shingles. The house with the roof covered with painted shingles showed the lowest temperature. On account of the heat deflecting properties of shingles, they will probably always find a wide application in warm climates. Shingled dwellings are much cooler in the summer than iron clad or stone roofed dwellings.

**Lumber World Review, Dec. 25, 1913.

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Choosing Proper Shingle Paint.

The selection of a proper shingle paint is a matter of considerable importance. In the first place, shingle paints should not be confused with "shingle stains." The latter, as a rule, consist of creosote oils thinned with petroleum or coal tar distillates, and colored with a small amount of mineral or chemical color pigment ground in linseed oil.

Editor's Note.—This is the complete text of an address delivered by H. A. Gardner, assistant director of the Institute of Industrial Research, Washington, D. C., and formerly the director of the scientific section of the Paint Manufacturers' Association of the United States. It is especially timely, because of the attention that is now being given to wooden structures because of their susceptibility to fire. Much chemical research has been indulged in, in order to secure the materials which will offer the strongest resistance to fire. Mr. Gardner's article will be found illuminating and it will be noted that he does not speak of a "fire-proof," but rather of a "fire retardant" paint. The distinction is necessary when one considers that thus far nothing has been discovered that will render wood absolutely fire-proof.

When shingles are treated with such stains, either by brushing or dipping, they present a very pleasing appearance, and become to a great extent preserved from ordinary forms of decay. Stained shingles, however, do not offer any resistance to combustion when in contact with fire. On this account the use of stained shingles upon roofs will probably be discontinued to some extent with the advent of a demand for shingled roofs treated with fire-retarding paints.

Fire-retarding paints may properly be divided into two groups, one of which is represented by oil-mineral paints and the other by paints which do not contain oil. The term "mineral paint" refers to that type of paint which is so widely used throughout the rural districts to decorate and preserve dwellings, barns and similar out-buildings. In the manufacture of these prepared mineral paints, various mineral pigments, in a finely divided and carefully prepared form, are ground in linseed oil and mixed with the proper driers and thinners. The content of mineral pigment in such paints varies from 50 to 70 per cent of the total. When such paints are applied to shingles a very durable, waterproof film results. This film of dried paint upon the surface of a shingle has the effect of laying or smoothing down the rough, fuzzy surface of the wood, thus eliminating at once an important source of fire danger. The paint film, moreover, is quite as resistant to moisture as a sheet of India rubber. The shingled dwelling upon which such paint has been used is practically rainproof. It is, moreover, made very attractive in appearance. Another important function is performed by the paint, in preventing the warping of shingles at the edge, thus doing away with the formation of pockets in which hot cinders might lodge and burn. The fourth and most valuable characteristic of mineral paint is its resistance to fire. While the oil content is more or less combustible, there is present in the dried paint film a minor proportion of oil, the major proportion consisting of mineral pigments which are unaffected by fire. A hot cinder or spark, falling upon a roof properly treated with a high grade mineral paint, would, in most instances, roll from the roof to the ground. There would be no pockets in which to lodge and burn. In the event of hot cinders falling with great force upon relatively flat roofs, the cinders would probably lodge upon the surface and burn away the superficial coating of dried oil, gradually dying out as they reached the fire resisting mineral pigment.

Good Paints Easily Obtainable.

Prepared mineral paints of good grade may be obtained at a moderate price at any modern paint shop. They are therefore within the reach of anyone who desires to use them for protecting shingled structures. If made by a reputable manufacturer, the purchaser may be sure that they are prepared from properly selected mineral pigments, carefully mixed with oil, and finely ground through rapidly revolving stone and steel mills, to a smooth condition. For coating shingles by dipping, such paints could be furnished in a thinner condition than for brushing.

At various times there have been placed upon the market fire-retarding solutions which have had more or less merit for the intended purpose. They consisted usually of water solutions of various salts, which when applied to canvas, scenery, or like materials, would dry and leave the material coated or impregnated with a quantity of the dried salts used in making the preparations. In treating wood or cloth with such salts, it was generally found necessary to apply several coats of the solution, sometimes as high as six or eight, in order to get satisfactory results. The chemicals used in many of these compounds are as follows. Ammonium phosphate, ammonium sulphate, ammonium chloride, sodium phosphate, calcium chloride, calcium oxychloride, calcium oxide, sodium carbonate, sodium chloride, borax, zinc chloride, zinc sulphate, etc. Sometimes the solutions contained casein or glue to give them binding or water resisting properties when spread and dried.

It is obvious that the application of brush coats of any of the above named salts to wooden shingles would not result in the formation of weather-resisting surfaces. It is the writer's belief, however, that a shingle manufacturer can at moderate cost impregnate shingles with certain mineral salts, which will make them more resistant to fire. Wooden beams and railroad ties are often rendered more durable by treatment with preservatives possessed of fungicidal properties, such, for instance, as creosote or zinc chloride. These chemical substances are forced deeply into the wood by special processes. It would, in the writer's opinion, be practical for the shingle manufacturer to adopt a similar process for mineralizing shingles. Mineral salts having a high resistance to fire, could be used for the impregnation base. Shingles thus mineralized could be rendered still more resistant to fire by subsequently applying a coat of mineral paint. The writer has experimented with various salts for this purpose, and has treated shingles with their solutions, both by brushing and by dipping. Shingles thus treated have shown much greater resistance to fire. The best results were obtained by mineralizing the shingles and subsequently coating them with mineral paint. The mineralizing process of making the wooden shingle thoroughly safe as a roofing material should be carried out in two steps. The shingle manufacturer should undertake the first process of treating the shingle with fire-resisting salts. If shingles thus impregnated are furnished the builder, it is quite certain that he will carry out the second and most important part of the process which consists in applying a decorative and waterproof coating of fire resistant mineral paint. It will, of course, be possible to use the old style creosote shingle stain over the mineralized shingle, in place of a mineral paint. However, the mineral paint will give much more satisfaction, as it forms a durable, waterproof film which is more resistant to fire than an ordinary stain.

Sodium Chloride Effective.

There will probably be considerable inquiry as to what constitutes the best kind

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of fire-resisting mineral salts for use in impregnating shingles. While any one of those previously mentioned would prove of value, it is probable that a mixture of such salts as may be compatible, will give the best results. Ordinary sodium chloride (common salt) is the cheapest mineral salt, and it is quite as effective as most mineral salts. Sodium silicate is also well adapted for this purpose.* The results of some recent experiments with sodium silicate are described below. Its solubility could be decreased by adding some substance which would act as a binder.

Sodium silicate (soluble water glass) has been used for many years in certain kinds of water paints, as a binder, and in some instances for its effect in retarding the spread of fire. The commercial form of silicate of soda (40 deg. Baume), when reduced with an equal quantity of water, forms a solution which is highly resistant to fire when spread and dried as a coating. Moreover, the cost of sodium silicate is low; a gallon of 20 deg. Be. solution may be made for five cents when produced in large quantities. When shingles are dipped or brushed with such a solution, the natural beauty of the wood is more favorably shown, and the coating dries rapidly to a hard, smooth film. If exposed to the air for some time, the film loses its high gloss and becomes more suitable as an undercoating for a mineral paint.

The use of fire-retarding paints of either type will probably not be restricted to shingles. There are many structural materials upon which these products may ultimately find a wide use. For instance, they might be used to a considerable extent in treating different types of railroad equipment. Rail ties laid upon trestles are often destroyed by large red hot cinders falling from the fire boxes of passing locomotives. The mineralizing of such ties and subsequent treatment with fire-retarding paints will probably reduce such damage to a material extent. For factory decoration and equipment preservation, paints of a fire resistant nature will find a wide application.

The writer, believing it desirable to have some standard by which to determine the fire-retarding nature of paints, made a search of various literature, in an effort to find tests outlined, which could be relied upon to give such data. Very little information along this line, however, could be obtained. In the book entitled "Fire Prevention and Fire Protection," by Freitag (John Wiley & Sons, publishers, New York City), pages 938 and 939, the following paragraphs appear:

"Fire-retarding Paints — So-called 'fireproof' paints, or the cold water compounds which are sold under a variety of trade names, all claiming fire-resisting properties, should be classed as fire-retardant rather than as fireproof. While wood or other combustible materials which have been coated with such compounds will successfully withstand the blaze of a match, a few minutes exposure to a greater heat, as of a lamp, will show that no great degree of fire-resistance exists. However, the **preventive** value of such coatings is material, especially for scenery, properties, and other stage fittings, in that the quick spread or 'flash' of fire over such materials will be greatly retarded, if not altogether prevented. The use of fire-retarding paints or solutions is, therefore, to be strongly recommended for scenery, etc., whether required by law or not. Some cities, notably New York, require 'all stage scenery, curtains and decorations made of combustible material, and all woodwork on or about the stage to be painted or saturated with some non-combustible material, or otherwise rendered safe against fire.'

"Acceptance of treatment depends on tests made by the Bureau of Buildings on the materials in each individual case.

"For fabrics, scenery and the wood frames of same, there must be no flame or glow after the application, for fifteen seconds, of the flame of an ordinary alcohol lamp or torch.

"For paints, the following regulations are made:

"First.—The term fireproof paint shall be understood to mean any preparation used to cover the surfaces of wood or other materials for the purpose of protecing the same against ignition.

"Second.—No fireproof paint will be considered satisfactory unless it so protects the wood or other material to which it is applied that the same will not flame or glow after having been subjected to the flame of a gasolene torch for two minutes.

"Third.—Before applying fireproof paint to any material the surfaces must be cleaned.

"Fourth.—Application of fireproof paint must be repeated whenever it is found that the material to which it is applied is no longer protected to fulfil Specification No. 2."

It is probable that the severe, two minute gasolene torch test outlined above was designed to be used upon paint coatings applied to thick trim. It is improbable that such a test could be withstood by a shingle painted with the most resistant of paints or even coated with a thin sheet of metal. The thin shingle, with its content of resins or oil, would probably carbonize, although the surface coating might be unaffected. To demonstrate this, the writer applied to several shingles a slush coating of neat Portland cement ⅛ inch thick. Another set of shingles was painted with a paint containing Portland cement as the pigment. After setting for three days, the coated shingles were subjected to a one minute torch test. The fire resisting effect of the Portland cement coatings was no better than that shown by a high grade oil-mineral oxide paint. The writer has therefore devised a series of tests to determine the suitability of paints as fire retardants. These tests are, of course, only offered as preliminary or tentative tests, for the study of testing engineers interested in the subject.

Torch Test.—A shingle shall be placed with the shank edge resting upon a tripod, the butt upon the table, at an incline of approximately 45 deg., thus corresponding to the position in which it would be placed upon a roof. A Bunsen burner shall be placed in a horizontal position, with the top within ½ inch of the shingle at a point 5 inches from the butt. The free flame of the burner shall be allowed to strike the shingle. At the end of one minute, the flame shall be removed. Painted shingles shall not show any deeply checked or charred condition of the wood below the paint. Blank tests should be made with untreated shingles of the same wood, for comparison and to determine the efficiency of the paint.

Fire Test.—Cut from the center of a shingle with a saw several small strips. That portion of the shingle should be selected, which will allow of the strips being of approximately the following dimensions: Thickness of upper edge, 3-16 inch; thickness of lower edge, 5-16 inch. The strips should be approximately 5-8 inch in width and approximately 8 inches in length. Nine of such strips may be prepared from a 6x20 shingle, if the wood is uniform and free from defects.

These shingle strips or "matches" should be given either a dipping or heavy brush coat of the paint under test. The upper

*Some chemical salts would cause rusting of the iron nails used in fastening shingles. The addition of an alkali or a soluble chromate to such types of salts would prevent this result.

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edge of the strip, for a space of 1¼ inches, should be left unpainted. After allowing 48 hours for the thorough drying of the paint, the strip should be held by the thick, painted lower edge in a horizontal position. The thin, unpainted upper edge should be placed in the free flame of a Bunsen burner, and ignited so that it burns freely when withdrawn. The strips should be kept in a horizontal position but occasionally may be revolved by turning the fingers so that the flame will have a good opportunity to reach every portion of the untreated wood. When the flame reaches the painted portion of the wood, it must die out and not have any appreciable effect thereon. A blank test may be carried out with an unpainted strip.

Summary of Conclusions.

The shingled roof is highly desirable on account of its durability, light weight, low cost and non-conducting properties.

Shingled roofs are subject to conflagration when they become dry. Hot cinders from chimneys or glowing sparks carried by the wind from nearby fires, are common causes of roof fires.

The use of high grade mineral paints upon shingled roofs eliminates such fire danger. Shingled structures of all types, when properly painted, are not only fire resistant, but they are moisture-proof and highly ornamental.

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"With this ever-increasing use of cement has come a desire for appropriate surface treatment for decorative purposes. There can be no doubt but that the successful treatment of cement surfaces with decorative coatings will lead to a much wider use of concrete, and the painter should be prepared to apply suitable coatings for all classes of cement work.

"Some complaints have been noted which point toward the fading of colored paints when applied to freshly laid cement walls. The alkaline lime present in the walls is a substance which becomes reactive in the presence of moisture, and under such conditions might prove destructive to certain paints. This difficulty, however, is easily prevented by treating the surface of all freshly laid cement work which is to be painted with a solution of zinc sulphate crystals* dissolved in water in the proportion of three pounds to a gallon. Cement surfaces thus treated may be painted with even more enduring results than wooden surfaces, and with the same types of paint that are most successfully used upon wood, namely, high-grade prepared paints made upon a lead and zinc base, preferably tinted. There may also be used the commercially prepared cement coatings which are specially designed for this purpose, and which are made upon a lead, zinc or lithopone base ground in a durable and flexible exterior vehicle. The above treatment and the use of the above named paints are to be recommended for the damp-proofing and decoration of all exterior concrete structures. This does not apply, however, to submerged masonry which is subjected to hydrostatic pressure. In the latter case special waterproofing paints made upon a bitumen base are used.

"For the decoration of interior cement walls in factories, office buildings, dwellings, hospitals, etc., the use of Flat Wall Paints is to be highly recommended.

"For all cement floors in buildings, as well as basements, engine rooms, etc., there may be used the alkali-neutralizing primer followed by specially designed, hard wearing floor paints which produce cleanly and pleasing surfaces free from the annoying dusting and disintegration which attends the use of unpainted cement floors."

*Machnichol method.

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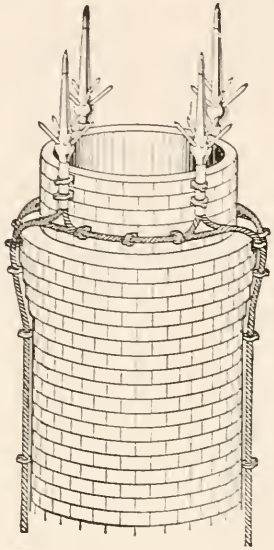

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SUGGESTIONS FOR LIGHTNING PROTECTION

The height and location of buildings have much to do with the method of installing a Lightning Protective System; therefore a general specification could not apply.

Lightning protection is more necessary for a tall building or smoke stack than for low buildings adjoining. Smoke stacks are particularly exposed to lightning discharges, because the column of hot gases which they discharge forms a conductor with less resistance than the air. These gases and the carbon accumulating at the top of a stack have a tendency, therefore, to attract lightning currents and if unprotected, have not sufficient conductive surface to carry the said lightning currents to safety. Flag poles and towers offer less resistance than does air and especially metal crosses at the top of high church spires, which like the gases from a smoke stack, invite the electrical disturbance. Farm buildings are as much exposed as a high building in the city because a farm building is the highest structure for miles around. Some of the most important factors in getting effective lightning protection are:

Good air terminals (preferably multiple points of heavy pattern, since the more points the more discharge).

Good copper cable conductors, because a cable in one continuous length has less resistance than a connected rod. This conductor should have at least 145,000 C.M. cross section and there should be at least two ground leads on each structure.

Effective grounds, preferably a pointed receptacle filled with powdered charcoal.

Good interwoven splices with round bends to make the discharge easy and without resistance.

Connect all metal in the neighborhood of lightning conductor.

Unless all these requirements are successfully met a lightning rod installation may be a positive menace.

Air terminals should extend at least 3 feet above the point to be protected and should be not less than ¾ inch in diameter. The air terminals should preferably be capped with a series of sharp points of a metal not easily fused. They should be placed over all the high parts of the building and any parts which are especially exposed. The effectiveness of the system is dependent to a great extent on the number and location of these air terminals.

The conductors should have a comparatively low resistance, and to this end should have a minimum number of joints. There should always be at least two and usually more conductors to ground. Conductors should be of copper cables ½" or more in diameter with a cross section of at least 150,000 circular mills.

Copper conductors on chimneys should be covered with lead within the gas zone to prevent corrosion on account of action of acids in the gases of combustion. All joints on the lead covering should be lead burned and not soldered as solder is subject to corrosion. Copper conductors should never be attached direct to galvanized iron or zinc to avoid electrolysis by formation of an electric battery with the two metals.

A lightning rod installation with good air terminals and poor conductors may actually increase the lightning hazard. The same truth applies to poor connections and grounds.

Conductors should be run over the ridges of the roof and at the corners of the building. They should have a minimum number of bends and sharp bends must be avoided entirely. Conductors should incline downward and should never rise after starting down. They should not be insulated, but should be bonded to metal gutters, down spouts, etc. Conductors should be run as far as practical from internal piping so as to avoid having part of the lightning discharge jump to this piping and in doing so start a fire.

If there is structural steel work or an elaborate system of piping (other than gas piping) extending from the top to the bottom of the building it is often desirable to bond this to the lightning conductors at both top and bottom.

The question of a suitable ground is particularly important as the operation of the entire system is dependent on a good ground. Even though the above-ground installation may be of the best, if the system is imperfectly grounded the chances are that lightning will jump from the conductor to some other and better ground and thus start a fire. As the underground portion of the system will never be inspected after it is once installed, it is of the utmost importance that every precaution be taken in its installation.

The best ground is probably an underground water pipe. If this is available the conductors should be soldered to brass plugs and these plugs screwed into the pipe. Sometimes the conductor is clamped directly to the pipe but this is objectionable as rust and corrosion at the point of contact may introduce a high resistance and thus spoil an otherwise good ground.

Whenever water pipe is not available a large copper ground plate or receptacle filled with crushed coke will give good results provided they are buried in earth which is moist at all seasons of the year. On account of the possibility of an imperfect joint or of injury to the ground connection and also because of the greater and easier discharge, it is always desirable to have the ground connections made in duplicate, that is, two ground receptacles for each vertical conductor. It is advisable to run a conductor underground, connecting all the vertical conductors.

We suggest you have some experienced lightning conductor concern who is thoroughly informed of all the requirements, make the installation. It may save you considerable annoyance, trouble and expense afterward. Remember, the better the installation the better the protection. To cheapen the installation means to reduce the efficiency.

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In rooms containing one or more horizontal angles between the floor and ceiling line, the ceiling to be measured from wall to wall, as though all walls were vertical, for contents of ceiling, and from floor to highest point of ceiling for height of wall.

OPENINGS.

Openings in plastering to be measured between grounds. No deductions to be made for openings of two feet or less in width. One-half of contents to be deducted for openings two feet or more in width. The contents on all store front openings to be deducted, and the contractor to be allowed one foot six inches for each jamb by the height.

All beams or girders projecting below ceiling line to have one foot in width by total length added for each internal and external angle.

No openings to be deducted from "solid" or "hollow" metal lath and plaster partitions nor for openings in suspended ceilings containing less than 100 square feet, where furring is carried around such openings by plasterer. No openings to be deducted from cement wainscot or base.

CORNER BEADS, ARCHES, ETC.

All corner angles of more or less than 90 degrees, beads, "bullnoses," quirks, rule joints, and moldings, to be measured by the lineal foot on their longest extension, and one foot for each stop or miter.

CORNICES.

Length of cornices to be measured on walls. Plain cornices of one foot girth or less to be measured on walls by the lineal foot. Plain cornices exceeding one foot girth to be measured by the superficial foot. Add one lineal foot to girt for each stop or miter. Enriched cornices (cast work), by the lineal foot for each enrichment.

Arches, corbels, brackets, rings, center pieces, pilasters, columns, capitals, bases, rosettes, bosses, pendants and niches, by the piece. Ceiling or frieze plates over eight inches wide, by the square foot.

COLUMNS.

All columns to be measured by the lineal foot for plain plastered columns.

CEMENT WAISCOATING AND BASE.

All cement wainscot to be measured by the square foot, and cement base by the lineal foot.

GROUNDS.

All grounds for various classes of work to be as follows, unless expressly specified to the contrary:

Grounds for 2-coat lath work.....⅞ inch
Grounds for 3-coat lath work..... 1 inch
Grounds for 3-coat metal lath work.⅝ inch
Grounds for 3-coat metal lath work, on ½-inch iron furring.....1⅛ inch
Grounds for 3-coat metal lath work, on 1-inch iron furring.....1⅝ inch
Grounds for hard mortar metal lath work .....⅝ inch
Grounds for hard mortar metal lath work, on ½-inch iron furring....1⅛ inch
Grounds for 2-coat work on brick or tile .....⅝ inch
Grounds for hard mortar on brick or tile .....⅝ inch
Grounds for hard mortar lath work.⅞ inch
Grounds for plaster board.....⅞ inch

Where metal lath is spoken of it applies to all wire or metal lath.

JURISDICTION CLAIMS.

By Plasterers' Union, any and all plastering regardless of the nature of the material or of the structure to which it is applied. By Lathers' Union, any and all lathing, metal corner beads, all light iron furring designed, specified or used primarily as a support for lath and plaster.

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Patching of plastering after other mechanics shall not be done as a part of the contract price and shall be paid for at the following scale of prices, which are in accordance with present wage agreements:

Plasterers .....90c per hour
Lathers .....90c " "
Laborers .....60c " "
Mortar .....$1.50 per bbl.
Putty .....$2.00 " "
Stucco .....70c per cwt. jute sack
Cement .....70c per cwt. jute sack
18 gauge ⅜" mesh painted wire lath or
24 gauge metal lath painted.25c per yard
1½ pine lath.....35c per bunch

CITY ORDINANCE.

Be it ordained by the City Council of the City of Chicago:

Section 1. That Section 605 of the Chicago Code of 1911 be and the same is hereby amended so as to read as follows:

605. **Wood Lathing and Plastering.)** (a) In all buildings of ordinary construction, where the use of wood lath and plaster is permitted under the provisions of this chapter, such wood lath and plaster shall be done in accordance with these specifications:

Wood lath shall not be over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than one-fourth of an inch apart. All wood lath must be covered with at least two coats of plaster; such lath and plaster to finish to a total thickness of at least seven-eighths of an inch; no dirty or loamy sand to be used in the mortar or plaster.

(b) In every building of ordinary construction which contains one or more rooms used for habitation or living purposes, the walls and ceilings of all rooms, including stores (except basement and attic rooms not used for habitation or living purposes), throughout the building shall be covered with not less than two coats of plaster of the thickness and quality hereinbefore in this section prescribed.

Provided, however, that where such building does not exceed one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in the room used for the purpose of Class I: and provided further, that where such building of ordinary construction and containing one or more living rooms is more than one story and basement in height and contains a room or rooms used for the purposes of Class I as defined in this ordinance, a metal ceiling may be installed in such room used for the purpose of Class I according to the following provisions:

The ceiling of the room or rooms used for the purpose of Class I shall first be plastered with at least one coat of plaster on wood lath; wood lath to be not over one and one-half inches wide, and shall be nailed to each stud, joist or bearing with not less than a three-penny fine 16 gauge nail; lath to have joints broken with not over seven lath to a break; lath to be spaced not less than three-eighths of an inch apart. All wood lath to be covered with a heavy coat of mortar; such lath and plaster to finish to a total thickness of three-quarters of an inch in thickness. Before applying such metal ceilings, a wood strip not less than seven-eighths of an inch by one and one-quarter inch wide shall be used under every lap bead, or nailing flange at the intersection of all plates. Strips to be not more than two feet on centers in the direction of length of rooms with a cross strip every four feet on centers. A wire nail not less than three inches long shall be used in every strip at every joist in the surface to be covered. Metal plates to be not lighter than 29 gauge in thickness and nailed to every six inches on the lap.

(c) Where said metal plates are applied on walls of buildings of ordinary construction containing one or more rooms used for habitation or living purposes, plastering upon walls must conform with the requirements of this ordinance for plastered walls. A strip three-eighths of an inch in thickness may be used upon which to apply the metal, same to be nailed to every studding with a nail not less than two and three-quarter inches long; steel plates used on walls to be not lighter than 29 gauge and applied same manner as herein provided for ceilings.

Section 2. This ordinance shall be in force and effect from and after its passage and due publication.

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GLASS AND GLAZING

The following data is given to satisfy the need of architects and draftsmen for definite information regarding conditions of manufacture, qualities and sizes of glass which are essential to accurate, practical specification and detail.

WINDOW GLASS is blown glass in distinction from plate or rolled glass. This glass being blown out in cylinders, either by hand or machinery, and the glass cylinders cut and straightened out. Such glass is likely to show a slight bulge and is frequently broken in setting or after setting, on account of the difference in tension between the two surfaces of the glass produced by straightening out or developing the cylinders of glass and not from any fault of the glazier.

Machine-Made "Double Strength" measures about nine lights to the inch in thickness. By far the major portion of all sheet glass on the market is machine made. It is not unusual to find large glazing houses with almost no hand-made glass in stock.

Hand-Made "Double Strength" sheet glass measures about eight lights to the inch in thickness. Inasmuch as it takes about fifteen men to blow and make the same amount of glass as one man with a machine, the purchaser must expect to pay more for hand-made than for machine-made glass, but hand-made glass of the same grade will show far less defects and is of greater strength.

"AA" Grade Sheet Glass is especially selected glass designed for picture use and is not manufactured in sufficient quantities to supply the demand of the market for Sheet Window Glass, so that where this glass is specified, the glazier usually substitutes "A" grade.

"A" Grade Sheet Glass is the standard quality of Sheet Window Glass used for the glazing of windows in the general run of buildings and is the best quality on the market in sufficient quantities to meet the demands for sheet glass window glazing.

"B" Grade Sheet Glass is an inferior grade, full of air bubbles and other defects, suitable only for cheap factory, greenhouses and similar work.

PLATE GLASS is poured and rolled, after which it is polished down on each side to the desired thickness. As it is almost impossible to gauge a polishing machine so that it will polish each end of the sheet the same thickness, plate glass, therefore, varies in thickness from 3/16″ to ⅜″, usually from ¼″ to 5/16″.

CAST OR ROLLED GLASS: This is really not a plate glass but it is a sheet glass and is cast on a table and then rolled, and in order to get the desired thickness what is known as trangs are used on the side of the table to govern the thickness of the glass.

"Rough" Glass gets its name from the rough surface of the table on which the glass is poured and then rolled, the lower surface being rough and the upper surface, which is the natural surface, being glossy

"WIRE GLASS" is rolled glass wherein the wire mesh is mechanically set at equal distance from each surface during the course of manufacture.

"Rough Wire" Glass is wire plate glass just as it comes from the rollers, without polishing.

ROUGH, RIBBED, MAZE, ROMANESQUE and SYENITE "WIRE GLASS" determine the style of surface which comes from the use of different figured tables.

POLISHED "WIRE GLASS" is made in the same way as Rough, Ribbed or Maze "Wire Glass" but is rolled in a rough sheet of sufficient thickness to polish down either side after the glass has been properly annealed. Quite frequently the mistake of specifying Polished Plate Wire Glass is made, whereas, Polished "Wire Glass" is not supposed to be a plate glass as it is taken from a tank furnace by a ladle which does not produce a product as free from bubbles as pouring the glass from a pot furnace as they do in making Polished Plate glass, therefore, specifications should call for Polished "Wire Glass".

RIBBED "WIRE GLASS" is rolled glass with the corrugated or grooved surface on the table side, thus allowing the smooth side of the glass to be glossy.

MAZE "WIRE GLASS" which, by the way, is highly recommended on account of its light diffusive powers is a figured rolled glass and the figure is produced on the table side of the glass, thus leaving the upper surface glossy.

ORNAMENTAL GLASS, which is more commonly known as figured glass, includes the following designs which are most popular: Romanesque, Apex, Pentecor, Maze, Syenite, Florentine, Ondoyant, together with other styles which are known according to the manufacturer's number, such as No. 1, No. 2, No. 3, etc. This style of glass is all rolled, some of the figures being produced on the table surface of the glass, thus leaving the upper surface glossy, while others are produced from a roller which necessitates the figure being on the upper surface and the lower surface of the glass which is flat has a dull appearance. The first mentioned process is by far the best.

"Chipped" Glass may either be chipped plate or chipped sheet glass, as chipping is accomplished by treating the surface of the glass with hot oil and then peeling off same, thus chipping the surface. Double chipping is accomplished by repeating the process, so that the architect when he specifies "chipped" glass should be particular to say whether he wishes sheet or plate, single or double chipped.

"Ground" Glass is produced by grinding the surface of any sort of glass with a sand blast process, so that the architect should

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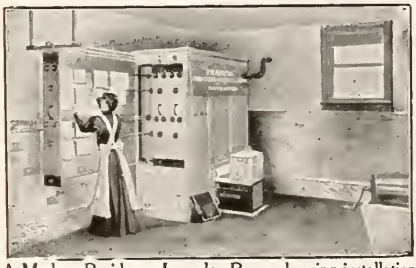

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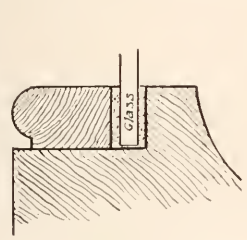
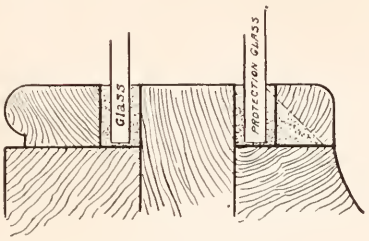
specify whether he wants plate or sheet glass when he specified ground glass.

We give below details approved and recommended by the National Ornamental Glass Manufacturers' Association of the United States and Canada as the minimum size of rabbets, jambs and sills for art glass glazing; also details for metal sash and ventilator construction. Rabbets for ordinary window glass glazing should never be less than ¼ of an inch in depth but should always be made at least ⅜ of an inch where this is practical from the standpoint of design.

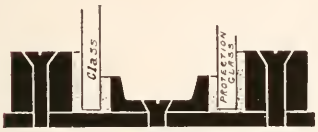


½ size—Single Glazing

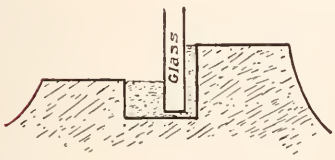


½ Size—Double Glazing

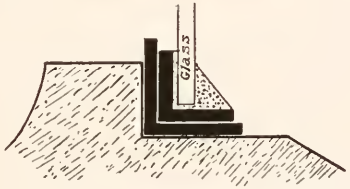
Some Details for Stone Omitting Loose Strips



½ Size—Metal Division Bars and for framing



½ Size—Stone Detail for Heads and Jambs



½ Size—For Sills and Showing Ventilator Setting

COLORED GLASS is produced by introducing various substances into the molten glass and by complicated processes of manufacture, the more expensive glass coming in sheets of irregular shape and thickness, the price varying according to the value of the coloring matter introduced. The precious metals such as gold and silver, are required for the production of certain colors which necessarily makes these expensive. On account of the big variation in price of the different coloring matter used in the manufacture of opalescent glass, this glass varies in cost according to color.

"Cathedral" Glass measures eight sheets to the inch and is practically uniform in color, this being practically the cheapest colored glass on the market.

"Opal Cathedral" Glass measures about eight sheets in thickness to the inch and is practically uniform in thickness, but showing in a measure the variation in color of opalescent or opal glass.

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Opalescent Glass varies in thickness from 1/16" to ¾" and also varies in color almost without limit. It is practically impossible to get exactly the same shade in two successive meltings of opalescent glass; in fact, many of the most beautiful sheets of opalescent glass have been mere accidents of manufacture. Where the art glass cutter and glazier is unable to secure the peculiar shade of color required in cartoon by cutting from any one sheet of glass in his stock he accomplishes this result by plating several sheets over each other, thus by a combination of the colors in the different sheets producing the shade desired.

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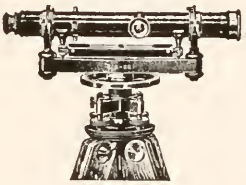

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MISCELLANEOUS AND USEFUL INFORMATION CONCERNING BUILDING ENGINEERING, TRADES AND MATERIALS.

The following pages contain tables, formulae, and miscellaneous information intended to be of assistance to architects in the preparation of plans, specifications, estimates, and the general supervision of the construction work. In order to make the classification simple and to follow a uniform system this matter is classified according to the Dewey System, see page 325, and the file or classification numbers are printed in small type at the head of each piece of matter falling under a different classification. As far as possible the names of authorities quoted are given but in some cases this has been impossible.

RULES AND FORMULAS FOR THE DESIGN OF SIMPLE WOOD BEAMS OR JOISTS.

When a beam is to be designed its length and the loads to which it is to be subjected are known, thus the maximum bending moment may be found.

The allowable-working-strength is assumed in accordance with engineering practice and must not be more than allowed by building laws, locally applicable. This allowable-working-strength is usually stated in municipal codes as a fixed number of pounds per square inch of cross sectional area, for each kind of material. This might just as well be stated in tons or any other unit of weight per square foot or any other unit of area, it being only important that whatever unit of dimension is used that the same unit shall be used both for areas, lengths and breadths.

Breadth-of-the-beam times the-square-of-the-depth divided by six equals Bending-Moment divided by allowable-working-strength per unit of area corresponding with unit of length used for stating the length and breadth of beam.

Bending-Moment (for beams uniformly loaded) equals weight-to-be-supported-per-unit-of-length times the-square-of-the-total-number-of-units-of-length divided by eight.

For a simple beam loaded with a single weight, the maximum-Bending-Moment (which is to be used in formula) equals the-entire-load times [(the-length-of-the-beam) minus (the-distance-of-the-load-from-the-left-hand-end)] times the-distance-of-the-load-from-the-left-hand-end-of-the-beam divided by the-length-of-the-beam.

If the load be movable the-distance-of-load-from-left-hand-end will be variable and the maximum-moment will be developed when the load is at the middle where the maximum-Bending-Moment is equal to one-fourth-the-load times the-length-of-the-beam. Placing the entire load on a beam at its center therefore produces the maximum strain that it is possible to produce on such beam by any position of such load.

APPLICATION OF ABOVE PRINCIPLES.

M=maximum bending moment.

S=the tensile or compressive unit stress per square inch allowable by building code or engineering practice for the material selected (See Section 539, Chicago Municipal Code, using the smallest value where there is a difference between compression and tension strength.)

l = length in inches of beam between supports.

b = breadth in inches of the beam.

d = depth in inches of the beam.

w = weight in pounds on beam including the weight of the beam itself per each inch of length.

W = total weight in pounds on beam = l w.

FOR UNIFORM LOADING.

$$b = \frac{3\ w\ l^2}{4\ d^2\ S} = \frac{3\ W\ l}{4\ d^2\ S} = \text{breadth of beam.} \qquad d = \sqrt{\frac{3\ w\ l^2}{4\ b\ S}} = \sqrt{\frac{3\ W\ l}{4\ b\ S}} = \text{depth of beam.}$$

To find b it is necessary to assume a value for d. Also to find d it is necessary to assume a value for b. In case it is found that the value by formula is too large or too small for practical use, then assumed value must be changed so as to bring the computed value to a practical size.

LOADS IN POUNDS (UNIFORMLY DISTRIBUTED)

TABLE OF STRENGTH OF YELLOW PINE BEAMS

WEIGHT OF BEAM INCLUDED

1910 CHICAGO BUILDING ORDINANCE

Fibre Stress 1300 lb. in². Shear 130 lb. in².

Each beam 3/8in. less than nominal width and depth

STRENGTH Unplastered Construction Width in Inches							DEFLECTION LIMITED Plastered Construction Width in Inches					
2 in.	3 in.	4 in.	6 in.	8 in.	10 in.	Span in feet.	2 in.	3 in.	4 in.	6 in.	8 in.	10 in.
6 in. Beam=5⅝ in. Load in pounds.							6 in. Beam=5⅝ in. Load in pounds.					
1491	2409	3327	5163	.....	.....	5	1491	2409	3327	5163	.....	.....
1243	2008	2773	4303	.....	.....	6	1243	2008	2773	4303	.....	.....
1066	1722	2378	3690	.....	.....	7	913	1475	2037	3161	.....	.....
932	1506	2080	3228	.....	.....	8	699	1129	1559	2419	.....	.....
828	1338	1848	2868	.....	.....	9	553	893	1233	1913	.....	.....
746	1205	1664	2582	.....	.....	10	450	727	1004	1558	.....	.....
678	1095	1512	2346	.....	.....	11	371	599	827	1283	.....	.....
621	1003	1385	2149	.....	.....	12	310	501	692	1074	.....	.....
8 in. Beam=7⅝ in.							8 in. Beam=7⅝ in.					
1955	3158	4361	6767	9173	.....	7	1955	3158	4361	6767	9173	.....
1711	2764	3817	5923	8029	.....	8	1711	2764	3817	5923	8029	.....
1523	2460	3397	5271	7145	.....	9	1351	2182	3013	4675	6337	.....
1370	2213	3056	4742	6428	.....	10	1094	1767	2440	3786	5132	.....
1245	2011	2777	4309	5841	.....	11	905	1462	2019	3133	4247	.....
1141	1843	2545	3949	5353	.....	12	761	1229	1697	2633	3569	.....
1053	1701	2349	3645	4941	.....	13	647	1045	1443	2239	3035	.....
978	1580	2182	3386	4590	.....	14	559	903	1247	1935	2623	.....
914	1476	2038	3162	4286	.....	15	488	788	1088	1688	2288	.....
856	1383	1910	2964	4018	.....	16	428	691	954	1480	2006	.....
10 in. Beam=9⅝ in.							10 in. Beam=9⅝ in.					
2709	4376	6043	9377	12711	16045	8	2709	4376	6043	9377	12711	16045
2426	3919	5412	8398	11384	14370	9	2426	3919	5412	8398	11384	14370
2183	3526	4869	7555	10241	12927	10	2183	3526	4869	7555	10241	12927
1986	3208	4430	6874	9318	11762	11	1803	2913	4023	6243	8463	10683
1820	2940	4060	6300	8540	10780	12	1518	2452	3386	5254	7122	8990
1677	2709	3741	5805	7869	9933	13	1292	2087	2882	4472	6062	7652
1560	2520	3480	5400	7320	9240	14	1117	1804	2491	3865	5239	6613
1454	2349	3244	5034	6824	8614	15	972	1570	2168	3364	4560	5756
1365	2205	3045	4725	6405	8085	16	855	1381	1907	2959	4011	5063
1284	2074	2864	4444	6024	7604	17	757	1223	1689	2621	3553	4485
1212	1958	2704	4196	5688	7180	18	676	1092	1508	2340	3172	4004
1149	1856	2563	3977	5391	6805	19	606	979	1352	2096	2840	3584
1092	1764	2436	3780	5124	6468	20	546	882	1218	1890	2562	3234

Continued on next page.

2 in.	3 in.	4 in.	5 in.	6 in.	8 in.	10 in.	12 in.	Span in feet.	2 in.	3 in.	4 in.	5 in.	6 in.	8 in.	10 in.	12 in.
12 in. Beam = 11⅝ in.									12 in. Beam = 11⅝ in.							
3550	5750	7930	10100	12350	16600	21100	25500	9	3550	5750	7930	10100	12350	16600	21100	25500
3200	5160	7150	9100	11100	15000	19000	23000	10	3200	5160	7130	9100	11100	15000	19000	23000
2910	4700	6500	8300	10100	13700	17400	20900	11	2910	4700	6500	8300	10100	13700	17400	20900
2650	4300	5910	7560	9200	12450	15750	19000	12	2500	4050	5590	7110	8670	11720	14800	17900
2460	3960	5470	7000	8500	11500	14550	17590	13	2125	3440	4750	6080	7380	9990	12600	15200
2290	3670	5070	6500	7890	10650	13450	16300	14	1840	2960	4100	5235	6360	8600	10850	13150
2140	3440	4740	6080	7350	9930	12650	15200	15	1600	2590	3570	4550	5540	7500	9450	11450
1990	3210	4440	5660	6900	9340	11800	14250	16	1405	2270	3140	4000	4860	6590	8500	10080
1870	3025	4160	5330	6490	8760	11050	13380	17	1250	2020	2790	3550	4325	5860	7400	8980
1770	2860	3950	5050	6120	8300	10500	12700	18	1115	1795	2490	3160	3850	5210	6580	8000
1670	2700	3740	4760	5800	7850	9900	12000	19	1000	1615	2230	2840	3455	4695	5910	7150
1590	2575	3550	4530	5500	7480	9430	11400	20	900	1450	2000	2555	3110	4220	5325	6450
1530	2450	3400	4335	5280	7200	9000	10900	21	810	1320	1820	2320	2820	3840	4840	5840
1450	2350	3250	4150	5050	6850	8650	10300	22	745	1200	1660	2120	2580	3500	4410	5340
1390	2250	3100	3950	4800	6550	8300	10000	23	680	1100	1520	1940	2350	3200	4040	4870
1340	2150	2970	3800	4600	6250	7900	9550	24	630	1010	1400	1780	2160	2940	3710	4500
14 in. Beam = 13⅝ in.									14 in. Beam = 13⅝ in.							
4000	6450	8900	11400	13850	18700	23700	28700	11	4000	6450	8900	11400	13850	18700	23700	28700
3660	5900	8150	10400	12650	17150	21600	26200	12	3660	5900	8150	10400	12650	17150	21600	26200
3360	5450	7520	9600	11650	15800	20000	24200	13	3360	5450	7520	9600	11650	15800	20000	24200
3140	5060	7000	8910	10850	14700	18580	22500	14	3140	5060	7000	8910	10850	14700	18580	22500
2925	4725	6520	8310	10100	13700	17300	20950	15	2750	4450	6130	7810	9500	12850	16250	19700
2745	4345	6130	7810	9500	12850	16250	19620	16	2400	3875	5350	6830	8300	11240	14200	17200
2590	4170	5760	7350	8940	12150	15300	18500	17	2125	3440	4750	6050	7360	9950	12600	15210
2440	3940	5450	6940	8430	11410	14410	17450	18	1900	3070	4250	5410	6580	8930	11250	13600
2310	3740	5160	6590	8000	10810	13650	16550	19	1700	2740	3790	4840	5880	7960	10100	12150
2195	3550	4900	6240	7600	10260	13000	15700	20	1535	2480	3425	4370	5320	7200	9090	11000
2090	3360	4660	5940	7240	9800	12390	14950	21	1395	2255	3120	3980	4840	6550	8270	10000
2000	3250	4450	5700	6900	9400	11900	14300	22	1270	2050	2830	3600	4400	5950	7500	9100
1900	3090	4250	5430	6600	9000	11350	13700	23	1160	1870	2590	3300	4000	5450	6850	8300
1830	2950	4090	5200	6320	8600	10900	13100	24	1070	1720	2370	3070	3690	5000	6300	7600
16 in. Beam = 15⅝ in.									16 in. Beam—15½ in.							
4410	7150	9860	12600	15400	20800	26400	31600	13	4410	7150	9860	12600	15400	20800	26400	31600
4100	6625	9150	11660	14200	19240	24280	29380	14	4100	6625	9150	11660	14200	19240	24280	29380
3830	6190	8540	10890	13240	17950	22650	27400	15	3830	6190	8540	10890	13240	17950	22650	27400
3580	5790	8000	10200	12400	16800	21205	25650	16	3565	5770	7970	10160	12350	16750	21190	25640
3380	5455	7545	9620	11700	15850	20000	24200	17	3180	5140	7095	9050	11000	14900	18830	22790
3185	5160	7120	9095	11050	14960	18900	22850	18	2840	4580	6325	8060	9810	13300	16800	20250
3020	4880	6745	8600	10450	14180	17900	21600	19	2540	4100	5655	7225	8790	11900	15050	18180
2865	4640	6400	8160	9925	13450	16980	20500	20	2290	3700	5105	6520	7930	10750	13550	16400
2740	4425	6110	7800	9430	12850	16200	19600	21	2080	3360	4640	5925	7200	9755	12310	14900
2610	4220	5825	7445	9050	12250	15490	18700	22	1895	3065	4240	5400	6560	8900	11230	13580
2500	4045	5590	7125	8660	11740	14810	17900	23	1740	2805	3880	4950	6025	8150	10300	12430
2400	3890	5370	6850	8150	11300	14300	17200	24	1600	2570	3580	4580	5580	7500	9500	11400
2300	3720	5150	6550	8000	10900	13700	16500	25	1470	2370	3300	4200	5100	6950	8750	10500
2220	3580	4930	6300	7650	10400	13100	15800	26	1360	2200	3030	3880	4700	6400	8100	9700
18 in. Beam = 17⅝ in.									18 in. Beam = 17⅝ in.							
4875	7860	10860	13860	16880	22850	28850	34950	15	4875	7860	10860	13860	16880	22850	28850	34950
4560	7370	10180	13000	15800	21400	27000	32650	16	4560	7370	10180	13000	15800	21400	27000	32650
4300	6950	9580	12210	14895	20180	25300	30750	17	4300	6950	9580	12210	14895	20180	25300	30750
4050	6550	9040	11520	14000	19000	24000	29000	18	4050	6550	9040	11520	14000	19000	24000	29000
3840	6210	8560	10930	13300	18030	22800	27500	19	3640	5880	8110	10350	12550	17080	21500	26100
3645	5895	8140	10350	12610	17100	21600	26050	20	3295	5320	7350	9350	11410	15400	19450	23550
3470	5610	7750	9890	12030	16300	20600	24850	21	3040	4900	6760	8630	10500	14200	17950	21700
3310	5350	7400	9450	11460	15550	19630	23750	22	2730	4400	6090	7750	9410	12750	16100	19500
3170	5120	7060	9000	10950	14850	18750	22650	23	2545	4110	5660	7230	8800	11900	15000	18200
3040	4920	6800	8625	10520	14260	18000	21800	24	2290	3700	5100	6510	7900	10700	13550	16400
2910	4700	6500	8300	10100	13700	17300	20800	25	2120	3400	4700	6000	7350	9900	12500	15100
2800	4510	6250	7980	9700	13200	16600	20000	26	1950	3150	4370	5600	6800	9200	11600	14000

TABLES OF WORKING STRESSES IN ORDINARY STRUCTURAL DESIGN

By BENJAMIN E. WINSLOW, M. W. S. E.

The tables and data given on pages 277, 278 and 279 are extracts from articles published by Mr. Winslow in "The Technograph"—(Editor)

Ultimate and Safe Strength of Concrete in Pounds Per Square Inch

Modulus of Elasticity of P. C. Stone Concrete 1:2:4—60 Days Old for Various Stresses	Modulus of Elasticity	Strength of 1:2:4 P. C. Stone Concrete for Various Ages	Compression on Top Fibers of Beams			Modulus of Elasticity	
			Ultimate		Safe	Ultimate	
	Ultimate		From	To	Av.	From	To
Initial Mod. of Elasticity....	2,000,000	1 Day Old	200	300	0		
E. for Stress of 400 lbs pr. □	1,700,000	2 " "	400	700	100		
" " " 600 " "	1,600,000	4 " "	600	1000	200	800,000	1,300,000
" " " 800 " "	1,500,000	7 " "	900	1500	375	1,200,000	2,000,000
" " " 1000 " "	1,400,000	1 Month Old.....	1200	2000	500	1,600,000	2,600,000
" " " 1200 " "	1,300,000	2 " "	1400	2300	575	1,800.000	3,000,000
" " " 1400 " "	1,100,000	3 " "	1500	2500	625	2,000,000	3,300,000
" " " 1600 " "	900,000	6 " "	1600	2700	675	2,200,000	3,600,000
" " " 1800 " "	600,000	1 Year Old.....	1700	2900	725	2,300,000	3,800,000
E. for Ultimate Strength....	0	2 " "	1800	3000	750	2,400,000	4,000,000

These tables will cover variations of the material and give the range of strength that could be expected of good ordinary materials and workmanship. Inferior materials will come below the lowest limits given in these tables, and superior materials will come above the highest limits. The safe compressive unit stress to be used for long columns should be obtained from the use of some approved column formulae, which also should take care of possible eccentric applications of the load.

The safe extreme fiber stress for long, narrow beams and girders, including plate girders, not braced sideways, should also be obtained from some approved column formulae. In this manner the lateral strength of beams is provided for.

The following method is believed to conform with good practice for computing loads in buildings:

Figure all parts of the building for the full dead load.

Figure joists and beams for the full live load.

Figure girders for 85 to 90 per cent of the live load.

Figure the columns supporting the roof and top story of a building for the full live load. For each succeeding story below, make a reduction of 5 per cent in the full live load coming on the columns. This reduction must however, not exceed 50 per cent of the full live load for a many stored building.

Figure the foundations for one-third of the full live load.

Ultimate and Safe Strength of Wood in Pounds Per Square Inch

MATERIAL	Extreme Fiber Stresses			Compression with the Grain			Compression Across the Grain			Modulus of Elasticity		Weight per Cubic Foot	
	Ultimate		Safe	Ultimate		Safe	Ultimate		Safe	Ultimate			
	From	To	Av.	From	To	Av.	From	To	Av.	From	To	From	To
Long Leaf Pine	7000	14000	1500	6000	9000	1500	1000	2000	350	1,500,000	2,250,000	40	50
Oregon Pine	7000	13000	1400	6000	9000	1400	900	1800	300	1,400,000	2,100,000	35	45
White Oak	6000	12000	1300	5000	8000	1300	1500	3000	500	1,300,000	1,950,000	45	55
Short Leaf Pine	6000	11000	1200	5000	8000	1200	900	1800	300	1,200,000	1,800,000	35	45
Spruce	5000	10000	1100	4000	7000	1100	800	1600	250	1,100,000	1,650,000	30	40
Norway Pine	5000	9000	1000	4000	6000	1000	700	1400	200	1,000,000	1,500,000	30	40
White Pine	4000	8000	900	4000	6000	900	600	1200	200	900,000	1,350,000	25	30
Fir	4000	7000	800	3000	5000	800	600	1200	200	800,000	1,200,000	25	30
Hemlock	3000	6000	700	3000	4000	700	600	1200	200	700,000	1,050,000	25	30
Cedar	3000	5000	600	3000	4000	600	500	1000	200	600,000	900,000	20	25

MATERIAL	Shear with the Grain			Shear Across the Grain			Tension with the Grain			Elastic Limit		Modulus of Resilience
	Ultimate		Safe	Ultimate		Safe	Ultimate		Safe	Ultimate		
	From	To	Av.	From	To	Av.	From	To	Av.	From	To	
Long Leaf Pine	400	800	150	4000	6000	1000	8000	15000	1700	6000	12000	3.0
Oregon Pine	400	700	140	4000	5000	900	8000	14000	1600	6000	11000	3.0
White Oak	400	1000	200	4000	6000	900	7000	14000	1500	5000	11000	3.0
Short Leaf Pine	350	700	120	3000	5000	800	7000	13000	1400	5000	10000	2.5
Spruce	300	600	110	3000	4000	800	6000	12000	1300	4000	9000	2.5
Norway Pine	300	600	100	3000	4000	700	6000	11000	1200	4000	8000	2.5
White Pine	300	600	90	2000	3500	600	5000	10000	1100	3500	7000	2.0
Fir	250	500	80	2000	3000	500	5000	10000	1000	3000	6000	2.0
Hemlock	200	400	70	2000	3000	500	4000	9000	900	2500	5000	2.0
Cedar	200	400	60	2000	2500	400	4000	8000	800	2500	4500	1.5

Ultimate and Safe Strength of Masonry in Pounds Per Square Inch.

MATERIAL	Compression			Safe Bearing	Modulus of Elasticity		Shear			Tension			Weight per Cubic Foot	
	Ultimate		Safe		Ultimate		Ultimate		Safe	Ultimate		Safe		
	From	To	Av.		From	To	From	To	Av.	From	To	Av.	From	To
Hard Brick Work in P. C.	2000	3000	200	275	1,500,000	2 500,000	.....	.....	.....	100	200	20	130	150
Common " P. C.	1500	2500	175	250	1,500,000	2,500,000	150	300	20	100	200	20	110	130
" " N C.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	.....	50	100	10	110	130
" " L. M.	800	1600	100	150	500,000	1,000,000	.....	.....	.....	20	40	5	110	130
" " P.C.&L.M.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	.....	50	100	10	110	130
Old Brick Work in P. C.	2000	3000	200	275	2,000,000	3,000,000	.....	.....	.....	120	250	25	110	130
" " " N. C.	1500	2500	175	250	1,500,000	2,000,000	.....	.....	.....	70	120	15	110	130
" " " L. M.	1000	2000	150	200	1,000,000	1,500,000	.....	.....	.....	25	50	7	110	130
Brick Piers in P. C.....	1500	2500	175	250	1,500,000	2,500,000	.....	.....	.....	100	200	20	110	130
" " L.M.....	800	1600	100	150	500,000	1,000,000	.....	.....	.....	20	40	5	110	130
Rubble Work in P. C...	1000	2000	150	200	1,500,000	2,500,000	.....	.....	.....	70	150	20	130	150
Coursed Rubble in P. C..	1500	2500	175	250	2,000,000	3,000,000	.....	.....	.....	100	200	20	140	160
Neat P. C.....	2000	4000	200	300	1,500,000	3,000,000	1200	2400	300	400	800	70	80	90
Neat N. C.....	1000	3000	175	250	1,000,000	2,000,000	700	1500	125	200	400	30	60	70
P. C. Mortar 1 : 3	1500	2500	175	250	1,000,000	2,000,000	200	400	35	200	400	30	120	130
N. C. Mortar 1 : 2	800	1500	150	200	800 000	1.500,000	150	300	25	100	200	20	120	130
Lime Mortar.....	200	400	100	150	500,000	800,000	50	100	10	20	40	5	90	110
P. C. Stone Concrete 1:2:4	1500	3500	400	500	1,500,000	3,500,000	800	1200	125	200	400	40	140	150
N C. " " 1:2:5	1000	2000	200	300	1,000,000	2,000,000	500	1000	80	150	300	25	140	150
P. C. Cinder 1:2:5	800	1600	150	200	500,000	1,000,000	70	120	10	100	150	20	100	110
Granite	12000	20000	400	600	3,000,000	6,000,000	1200	2400	300	1200	2400	200	160	180
Limestone.	6000	12000	350	500	2,000,000	5,000,000	1000	2000	175	1000	2000	175	150	170
Sandstone.....	5000	10000	300	400	1,000,000	3,000,000	800	1600	125	800	1600	125	140	160
Brick and Tile.....	2000	5000	200	300	1,000,000	3,000,000	500	1000	80	500	1000	80	120	140

Metric Tables.

		Approximate. Equivalent		Accurate. Equivalent
1 inch	[length]	2½	cubic centimeters	2.539
1 centimeter		0.4	inch	0.393
1 yard		1	meter	0.914
1 meter (39.37 inches)		1	yard	1.093
1 foot		30	centimeters	30.479
1 kilometer (1,000 meters)		⅝	mile	0.621
1 mile		1½	kilometers	1.600
1 gramme	[weight]	15½	grains	15.432
1 grain		0.064	gramme	0.064
1 kilogramme (1,000 grammes)		2.2	pounds avoirdupois	2.204
1 pound avoirdupois		½	kilogramme	0.453
1 ounce avoirdupois (437½ grains)		28⅓	grammes	28.349
1 ounce troy, or apothecary (480 grains)		31	grammes	31.103
1 cubic centimeter	[bulk]	1.06	cubic inch	1.060
1 cubic inch		16⅓	cubic centimeters	16.386
1 liter (1,000 cubic centimeters)		1	U. S. standard quart	0.946
1 United States quart		1	liter	1.057
1 fluid ounce		29½	cubic centimeters	29.570
1 hectare (10,000 square meters)	[surface]	2½	acres	2.471
1 acre		0.4	hectare	0.40

In the nickel five-cent piece of our coinage is a key to the tables of linear measures and weights. The diameter of this coin is two centimeters, and its weight is five grammes. Five of them placed in a row will give the length of the decimeter, and two of them will weigh a decagram. As the kiloliter is a cubic meter, the key to the measure of length is also the key to the measure of capacity.

Handy Table.

Diameter of a circle × 3.1416 = circumference.
Radius of a circle × 6.283185 = circumference.
Square of the diameter of a circle × 0.7854 = area.
Square of the circumference of a circle × 0.07958 = area.
Half the circumference of a circle × half its diameter = area
Circumference of a circle × 0.159155 = radius.
Square root of the area of a circle + 0.56419 = radius.
Circumference of a circle × 0.31831 = diameter.
Square root of the area of a circle × 1.12838 = diameter.
Diameter of a circle × 0.86 = side of inscribed equilateral triangle.
Diameter of a circle × 0.7071 = side of an inscribed square.
Circumference of a circle + 0.225 = side of an inscribed square.
Circumference of a circle × 0.282 = side of an equal square.
Diameter of a circle × 0.8862 = side of an equal square.
Base of a triangle × ½ the altitude = area.
Multiplying both diameters and .7854 together = area of an ellipse.
Surface of a sphere × ⅙ of its diameter = solidity.
Circumference of a sphere × its diameter = surface.
Square of the diameter of a sphere × 3.1416 = surface.
Square of the circumference of a sphere × 0.3183 = surface.
Cube of the diameter of a sphere × 0.5236 = solidity.
Cube of the radius of a sphere × 4.1888 = solidity.
Cube of the circumference of a sphere × 0.016887 = solidity.
Square root of the surface of a sphere × 0.56419 = diameter.
Square root of the surface of a sphere + 1.772454 = circumference.
Cube root of the solidity of a sphere × 1.2407 = diameter.
Cube root of the solidity of a sphere × 3.8978 = circumference.
Radius of a sphere × 1.1547 = side of inscribed cube.

Square root of ($\frac{1}{8}$ of the square of) the diameter of a sphere = side of inscribed cube.
Area of its base × $\frac{1}{8}$ of its altitude = solidity of a cone or pyramid, whether round, square, or triangular.
Area of one of its sides × 6 = surface of a cube.
Altitude of trapezoid × $\frac{1}{2}$ the sum of its parallel sides = area.

TABLE OF SQUARE ROOTS.

No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root.
25	5.	650	25.46	1400	37.42	2600	50.99
50	7.071	700	26.46	1450	38.08	2700	51.96
75	8.66	750	27.39	1500	38.73	2800	52.91
100	10.00	800	28.28	1550	39.37	2900	53.85
125	11.18	850	29.15	1600	40.00	3000	54.77
150	12.25	900	30.00	1650	40.62	3200	56.57
175	13.23	950	30.82	1700	41.23	3400	58.30
200	14.14	1000	31.62	1800	42.43	3600	60.00
250	15.81	1050	32.40	1900	43.59	3800	61.64
300	17.32	1100	33.16	2000	44.72	4000	63.24
350	18.70	1150	33.91	2100	45.82	4200	64.80
400	20.00	1200	34.64	2200	46.90	4400	66.32
450	21.21	1250	35.36	2300	47.95	4600	67.82
500	22.36	1300	36.06	2400	48.99	4800	69.28
550	23.45	1350	36.74	2500	50.00	5000	70.72
600	24.49						

Dimensions of a Barrel.—Diameter of head, 17 inches; bung, 19 inches; length, 28 inches; volume, 7,680 cubic inches.

Expansion of Water (Dalton).

Temperature.	Expansion.	Temperature.	Expansion.	Temperature.	Expansion.
22°	1.0009	72°	1.0018	152°	1.01934
32	1	92	1.00477	172	1.02575
*46	1	112	1.0088	192	1.03265
52	1.00021	132	1.01367	212	1.0466

*Greatest density at 39.1° Fahr.

A box 24 inches long by 16 inches wide and 28 inches deep will contain a barrel, or three bushels; 24 by 16 inches and 14 inches deep contains half a barrel; 16 inches square and $8\frac{2}{5}$ inches deep will contain one bushel; 16 by $8\frac{2}{5}$ inches and 8 inches deep will contain half a bushel; 8 by $8\frac{2}{5}$ inches and 8 inches deep will contain one peck; 8 inches square and $4\frac{1}{5}$ inches deep will contain one gallon; 7 by 4 inches and $4\frac{4}{5}$ inches deep will contain half a gallon; 4 inches square and $4\frac{1}{5}$ inches deep will contain one quart; 4 feet long, 3 feet 5 inches wide and 2 feet 8 inches deep will contain one ton of coal, or 36 cubic feet.

Table Showing the Pressure of Water at Different Elevations.

Feet Head	Equals Pressure per Square Inch.	Feet Head	Equals Pressure per Square Inch	Feet Head.	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch.	Feet Head.	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch
1	.43	65	28.15	130	56.31	195	84 47	260	112 62	350	151 61
5	2 16	70	30.32	135	58.48	200	86 63	265	114 79	360	155.94
10	4 33	75	32 48	140	60.64	205	88 80	270	116.96	370	160.27
15	6.49	80	34 65	145	62 81	210	90 96	275	119.12	380	164.61
20	8.66	85	36.82	150	64.97	215	93 14	280	121.29	390	168 94
25	10.82	90	38 98	155	67.14	220	95.30	285	123.45	400	173.27
30	12 99	95	41.15	160	69.31	225	97.49	290	125 62	500	216 58
35	15 16	100	43 31	165	71.47	230	99.63	295	127.78	600	259.90
40	17.32	105	45.48	170	73.64	235	101.79	300	129.95	700	303 22
45	19 49	110	47 64	175	75.80	240	103.96	310	134.28	800	346.54
50	21.65	115	49.81	180	77.97	245	106 13	320	138 62	900	389 86
55	23.82	120	51.98	185	80.14	250	108 29	330	142 95	1.000	433 18
60	25 99	125	54.15	190	82.30	255	110 46	340	147 28	. ..	.

Some of the Physical Properties of Metals—Compiled from the Best Authorities.

Common Name.	Chemical Name.	Initial.	Atomic Weight.	Specific Gravity.	Weight Cubic Inch.	Weight Cubic foot.	Melting Point F.	Specific Heat.	Conductivity of Heat.	Conductivity of Electricity.	Expansion 32 to 212° F.	Hardness, the Diamond.=3010.	Density.	Ductility, Gold being 1.	Malleability, Gold being 1.	Approximate price per lb, avoirdupois.
Hydrogen	Same.....	H.	1.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Aluminum	Same.....	Al.	27.3	2.55	.0924	159.005	1160	.214	31.33	.....	.....	821	.....	.....	.....	$ 16.30
Antimony.....	Stibium	Sb.	122.0	6.71	.242	418.402	842	.0508	4.03	4.6	.....	.....	.....	.....	.....	0.36
Bismuth	Same.....	Bi.	207.5	9.823	.354	612.513	510	.0308	1.8	1.1	. 004	.....	10.035	.....	.....	1.95
Cadmium	Same.....	Cd.	111.6	8.60	.31	536.253	500	.0567	20.06	.....	.0094	760	8.217	.....	.....	3.26
Copper	Cuprum	Cu.	63.3	8.82	.318	549.971	1930	.093	74.8	94.1	.0051	1360	.....	6	3	0.22
Gold	Aurum	Au.	196.2	19.32	.697	1224.699	1915	.0324	54.8	73.0	.....	979	.....	1	1	299.72
Indium	Same.....	Ir.	196.7	22.42	.809	1392.999	4500	.0326	.....	.....	.....	984	.....	.....	.....	466.59
Iron.....	Ferrum	Fe.	55.9	7.8	.281	486.369	3000	.1138	10.1	15.5	.0035	1375	.....	4	8	0.015
Lead	Plumbum.....	Pb.	206.4	11.37	.410	708.976	625	.0314	7 9	7.6	.0084	570	10.370	9	6	0.06
Magnesium	Same.....	Mg.	23.94	1.74	.628	89.791	1200	.25	34.3	.....	.0083	726	.....	.....	.....	45.30
Manganese....	Same.	Mn.	58.8	8.0	.289	498.84	3420	.122	.....	.....	.....	1456	.....	.....	.....	108.72
Mercury.....	Hydrargyrum.	Hg.	199.8	13.58	.490	846.781	39	.0317	1.3	.....	.0182	0	.....	.....	.....	1.00
Nickel.....	Same.....	Ni.	58.6	8.80	.318	551.842	3000	.109	... .	13.1	.0038	1410	.....	5	9	5.80
Platinum	Same.....	Pt.	196.7	21.50	.777	155.887	3200	.0324	9.4	16.6	.0027	1107	.....	3	5	122.31
Potassium	Kalium	K.	39.04	.875	.0316	54.561	110	.166	.....	.....	.....	230	.....	.....	.....	22.65
Silver	Argentum	Ag.	107.66	10.53	.38	656.598	1750	.056	100.00	100.0	.0056	990	.....	2	2	18.60
Sodium.....	Natrium	Na.	23.0	.9735	.035	60.503	170	.293	36.5	.....	.....	400	.....	.....	.....	3.26
Steel	.....	.....	.....	7.854	.283	489.736	2550	.1165	11.6	12.0	.....	.....	.....	... ..	.....	0.025
Tin	Stannum	Sn.	117.8	7.293	.263	454.754	440	.055	15.4	11.4	.0069	651	7.025	8	4	0.25
Zinc	Same.....	Zn.	64.9	7.14	.258	444.215	780	.096	36.0	29 0	.0088	1077	6.480	7	7	0.10

LAW OF SPECIFIC HEAT—In order to raise the temperature of different bodies the same number of thermometric degrees very different amounts of heat are required. The atoms of the solid element possess sensibly the same specific heat.

DUCTILITY—The property of being drawn into wire or threads.

MALLEABILITY—The capacity of being extended in all directions by beating with the hammer.

Weights of Materials.
Dry Woods.

	Lbs. Board ft.	Lbs. Cubic ft.		Lbs. Board ft.	Lbs. Cubic ft.
Apple	4.1	49.	Iron Wood	6.	71.
Ash, American white	3.9	47.	Larch	3.	35.
Birch	3.9	45.	Lignum vitæ	6.9	83.
Beech	3.7	43.	Mahogany, Honduras	2.9	35.
Boxwood	5.	60.	Mahogany, Spanish	4.4	53.
Cedar, American	2.9	35.	Maple	4.1	49.
Cedar, W. Indian	3.9	47.	Maple, soft	3.5	42.
Cedar, Lebanon	2.5	30.	Oak, live	4.9	59.3
Cherry	3.5	42.	Oak, red	3.9	45.
Chestnut	3.4	41.	Oak, white	4.3	52.
Cork	1.3	15.	Pine, Southern	3.7	45.
Elm	2.9	35.	Pine, white	2.1	25.
Ebony	6.3	76.1	Pine, yellow	2.8	34.3
Hemlock	2.1	25.	Spruce	2.1	25.
Hickory	4.4	53.	Sycamore	3.1	37.
Hornbeam	2.9	47.	Walnut	3.2	38.

Building Materials Stacked.

	Lbs. Cubic ft.		Lbs. Cubic ft
Brick, pressed	150	Granite or limestone, rubble work	138
Brick, common	125	Granite or limestone, well dressed	165
Cement, Portland	100	Limestones and marbles	168
Cement, Rosedale	56	Lime, quick	53
Common brickwork, cement mortar	130	Mortar, hardened	103
Common brickwork, lime mortar	120	Plaster of paris	70
Concrete cement	150	Sand	90-106
Earth dry, shaken	82 to 92	Sandstone	151
Earth, rammed	92 to 100	Shales	162
Glass, window	157	Slate	175
Granite	170	Trap rock	187

BUILDING MATERIALS IN CONSTRUCTION.

Roof Covering.

	Lbs. per sq. ft.
Shingles, wood, 16"	2.
Tin and paint	1.
Iron sheet black paint	1.5
Iron, galvanized	1 to 3.
Iron, corrugated	1 to 3.75
Copper, sheet	.75 to 1.25
Sheet Lead (See File 695)	4 to 8.
Zinc	1 to 2.00
Ready Compo Roofing	1 to 1.50
Felt and gravel	8 to 10.00
States, average (See File 695)	10.00
Tiles, plain, average	12.00
Tiles, fancy, laid in mortar	25 to 30.

Sheathing, Flooring, Etc.

Pine, Hemlock, Spruce, Poplar, Redwood, per inch thick	3.
Chestnut or Maple	4.
Ash, Hickory, L. L. Y. P., Oak	5.
Brick arches, 4" thick & concrete	70.
Porous tiles for slating, without slate	10.
Hollow tiles, 3.75" flat	12.
Hollow tiles, 6" arches	22.
Hollow tiles, 9" arches	36.

Joists and Rafters.

	Lbs. per sq. ft.
White pine, 2"x4", 16" o, c	1.5
Y. P. 2"x4", 16" o, c	2.5
White pine, 2"x6", 16" o, c	2.25
Y. P. 2"x6", 16" o, c	3.75
White pine, 2"x8", 16" o, c	3.00
Y. P. 2"x8", 16" o, c	5.0
White pine, 2"x10", 16" o, c	3.75
Y. P. 2"x10", 16" o, c	6.25

Purlines.

Wood, if supporting rafters 1 to 3
Iron or Steel, if supporting rafters 2 to 4

Ceiling.

Wainscoting or D. M. & B. stuff, same as sheathing.
Lath and plaster, 2 coats 9
Lath and plastering, 3 coats 10
Light book tiles, supported by T-bars without plastering 5

Live Loads.

See building code. Snow load for New York City, Cleveland, Chicago, Des Moines, averages about 20 lbs.

Weight per Square Foot of Sheet Lead.

1/32	inch thick	2	lbs.
3/64	" "	2½	"
1/25	" "	3	"
1/16	" "	4	"
1/14	" "	5	"
1/12	" "	6	"
1/10	inch thick	7	lbs.
1/8	" "	8	"
5/32	" "	10	"
3/16	" "	12	"
7/32	" "	14	"
1/4	" "	16	"

PLANS, SPECIFICATIONS AND ESTIMATES.

NOMENCLATURE OF DRAWINGS.

FILE 892

In response to a request sent out to a large number of prominent architects to send in copies of nomenclature used on their drawings, it was found that this varied with practically every architect, the result being that contractors estimating in different offices are compelled to memorize a large number of different systems of notation before being able to read plans intelligently; same rule applies to draughtsmen going from one office to another, all of which causes much waste of time and greatly increases the possibility of error. With this as an excuse we offer the following series of symbols, selected from the various systems with the hope that it will be generally adopted and thus bring about a greater uniformity of drawing nomenclature. The lighting symbols are taken from the standard symbols for wiring plans, prepared by the National Electrical Contractors Association of the United States. The structural iron symbols are taken from he Osborne system of nomenclature most generally used by structural iron contractors. General symbols are collated from various sources.

· GENERAL SYMBOLS ·

- (9) 8"×10" — GIRDER; NUMERALS INDICATES SIZE, ENCLOSED NUMERAL IND. PARTICULAR GIRDER.
- (7) SIZE HERE — COLUMN; SMALL NUMERAL INDICATES NUMBER OF PARTICULAR COLUMN
- (25) — DOOR; SMALL NUMERAL INDICATES NUMBER OF PARTICULAR DOOR
- 30 W — WINDOW, SMALL NUMERAL INDICATES NUMBER OF PARTICULAR WINDOW
- N 3 — INDICATES DESIGNATING NUMBER OF ROOM
- (+7'-6) — ELEVATION OF POINT SMALL NUMERALS INDICATE. DISTANCE ABOVE ZERO POINT IF PRECEEDED BY — REFERS TO POINT BELOW ZERO.
- BRICK
- CONCRETE
- WALLS WITH WOOD FURRING & LATH & PLASTER
- " " " METAL " " " " "
- " " " TILE " & PLASTER
- HOLLOW TILE CONSTRUCTIOI
- WALL OF WOOD STUDS & LATH & PLASTER
- STONE
- RUBBLE
- Rs — RUBBLE STONE
- D — DIMENSION STONE
- A — ASHLAR STONE
- Ad — DRESSED ASHLAR
- Ar — ROCK FACED ASHLAR
- d — ANY STONE DRESSED
- ? — NOT DESCRIBED SMALL NUMERALS REFER TO DETAILS & SPECIFICATIONS
- STORM SEWER
- DRAINAGE SYSTEM
- SANITARY SEWER

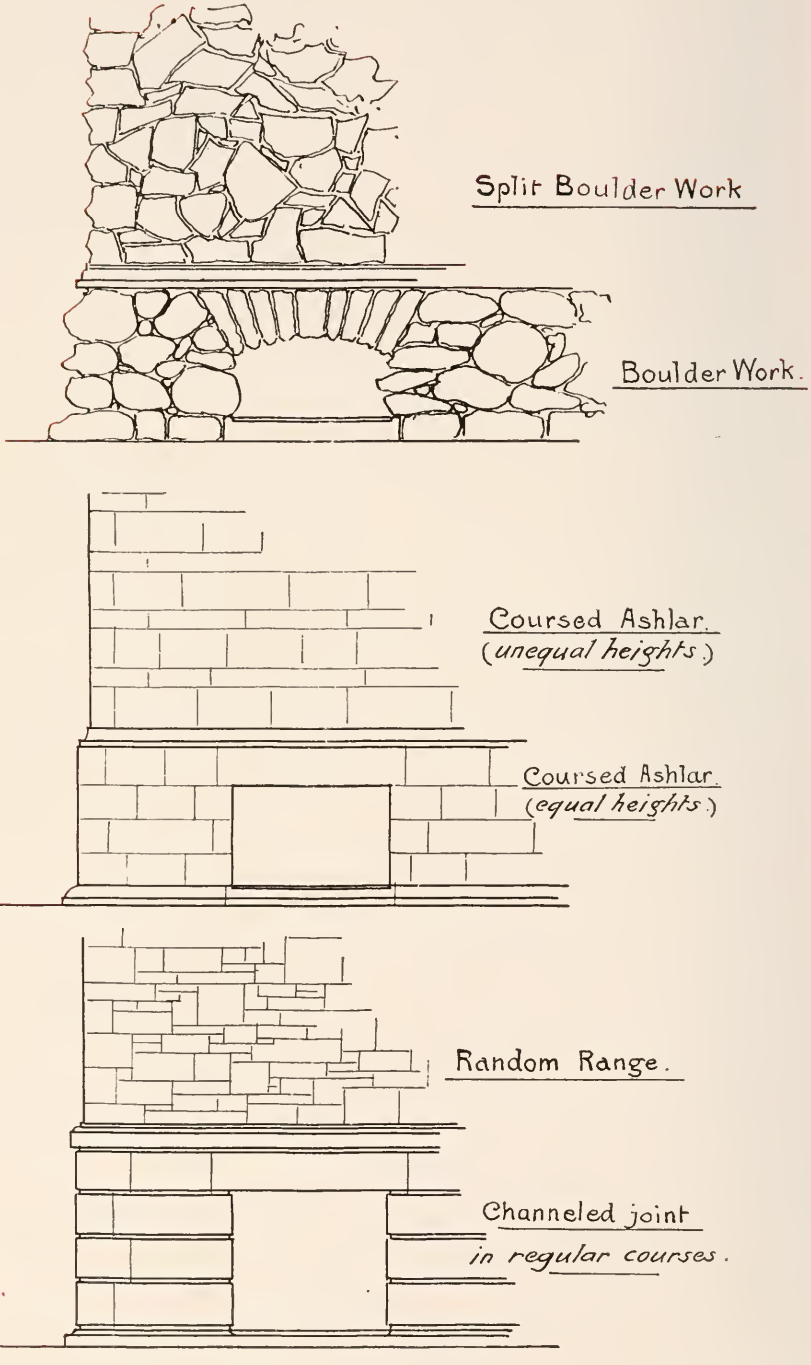
· LIGHTING SYMBOLS ·

- (4) — CEILING OUTLET · ELECTRIC ONLY. NUMERAL IN CENTER INDICATES NO. OF STANDARD 16 C.P. INCAND. LAMPS.
- 4½ — CEILING OUTLET COMBINATION. ½ INDICATES 4-16 C P INCANDESCENT LAMPS & 2 GAS BURNERS
- (2) — BRACKET OUTLET ELECTRIC ONLY NUMERAL INDICATES NO. OF STANDARD 16 C.P INCAND LAMPS.
- 4½ — BRACKET OUTLET · COMBINATION. ½ INDICATES 4-16 C P INCANDESCENT LAMPS & 2 GAS BURNERS
- [2] — WALL OR BASE BOARD RECEPTACLE OUTLET. NUMERAL IN C. INDICATES NO. OF ST'D 16 C.P. INCAND. LAMPS.
- [4] — FLOOR OUTLET. NUMERAL IN C. INDICATES NO OF ST'D 16 C.P. INCAND. LAMPS
- BELL OUTLET
- ARC LAMP OUTLET
- BUZZER OUTLET
- CEILING FAN OUTLET
- SPECIAL OUTLET, FOR LIGHTING, HEATING & POWER CURRENT AS DESCRIBED IN SPECIFICATIONS.
- TELEPHONE OUTLET · PRIVATE SERVICE
- " " " PUBLIC SERVICE
- SPEAKING TUBE
- DOOR OPENER
- 4 — CEILING OUTLET, GAS ONLY. NUMERAL INDICATES NO. OF GAS BURNERS
- 2 — BRACKET OUTLET " " " " " "
- F — OUTLET FOR FUEL GAS

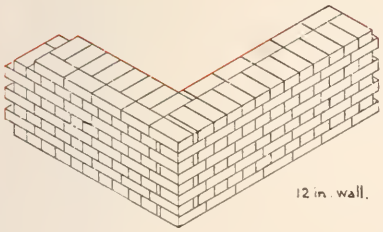
· SYMBOLS FOR HEATING PLANS ·

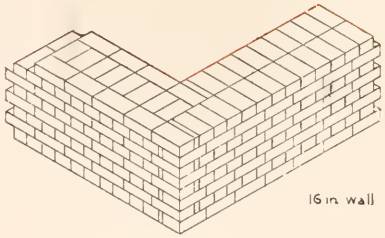
- (5) — SMALL NUMERAL DESIGNATES PARTICULAR RISER ARROW LOCATES SAME & INCH FIGURE GIVES SIZE.
- (12) — SMALL NUMERAL DESIGNATES PARTICULAR RADIATOR
- 6" — SMALL NUMERAL IN INCHES GIVES SIZE AND ARROW LOCATES FEED
- 6" — " " " " " " " RETURN
- INDICATES DIRECTION OF FLOW
- " " " FOUL AIR
- H / A — HOT AIR
- (14) 12"×14" — ENCLOSED NUMERAL INDICATES PARTICULAR REGISTER, INCHES INDICATE SIZE
- 5 12" — SMALL NUMERAL INDICATES NO OF LEADER, INCHES INDICATE INTERIOR DIAMETER, ARROW INDICATES DIRECTION OF FLOW
- 31½"×13½" (7) — SMALL NUMERAL INDICATES NO OF PARTICULAR STACK, INCHES INDICATE SIZE

Suggestions for Setting Stone.



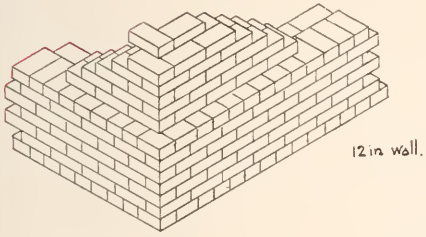
Bonds Used in Laying Brickwork.

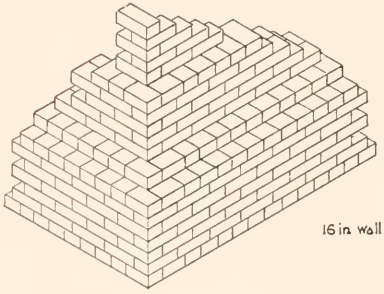




English Bond.

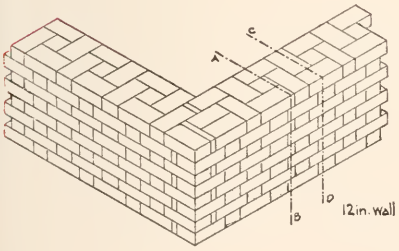
One row of headers and one of stretchers in alternate courses.

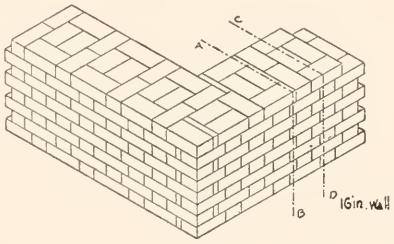




Chicago Bond.

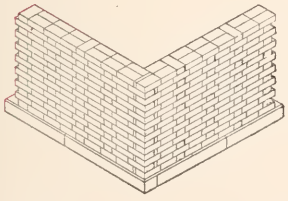
One row of headers and five courses of stretchers.





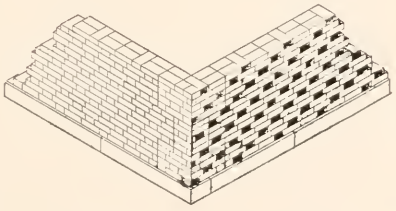
Flemish Bond.

Headers and stretchers alternating in each course.



English Garden Wall Bond.

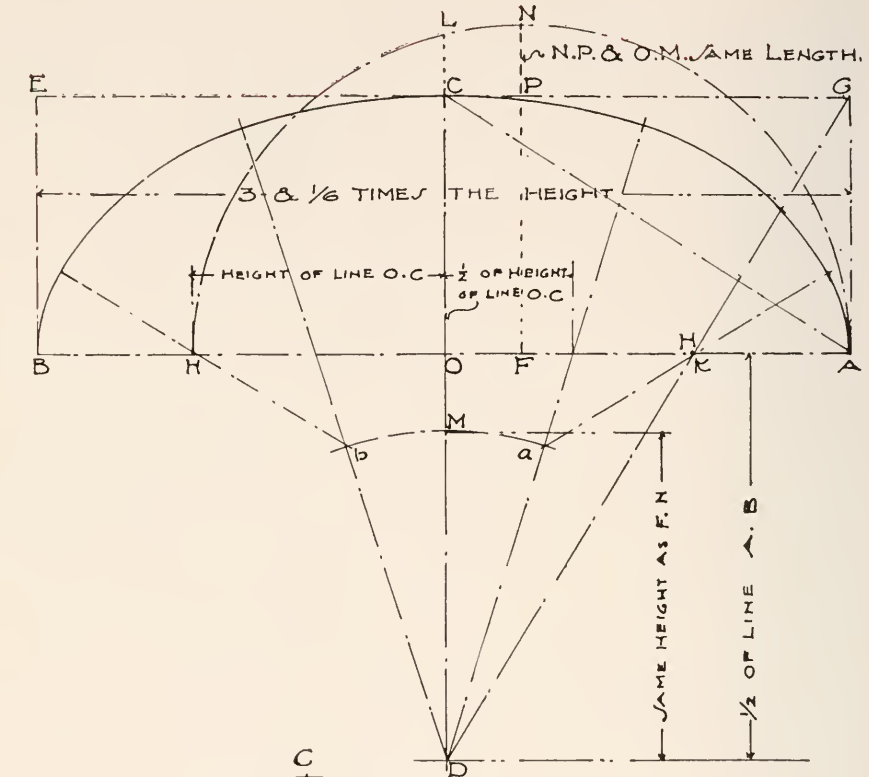
Three stretchers and one header alternating in each course.

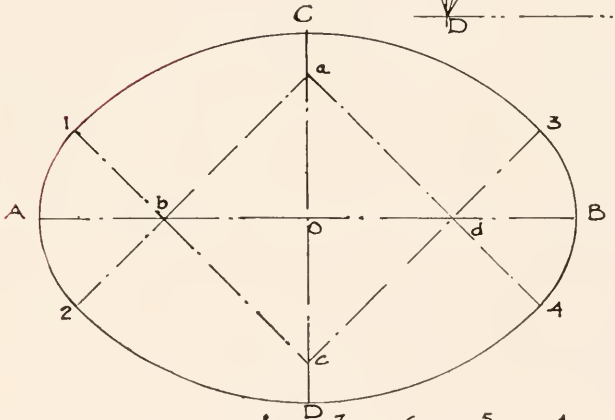


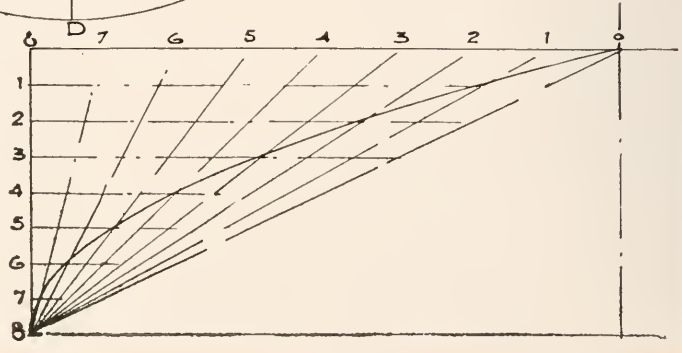
German Cross Bond.

Two stretchers and one header alternating in each course.

PROBLEMS ON THE ELLIPSE & PARABOLA



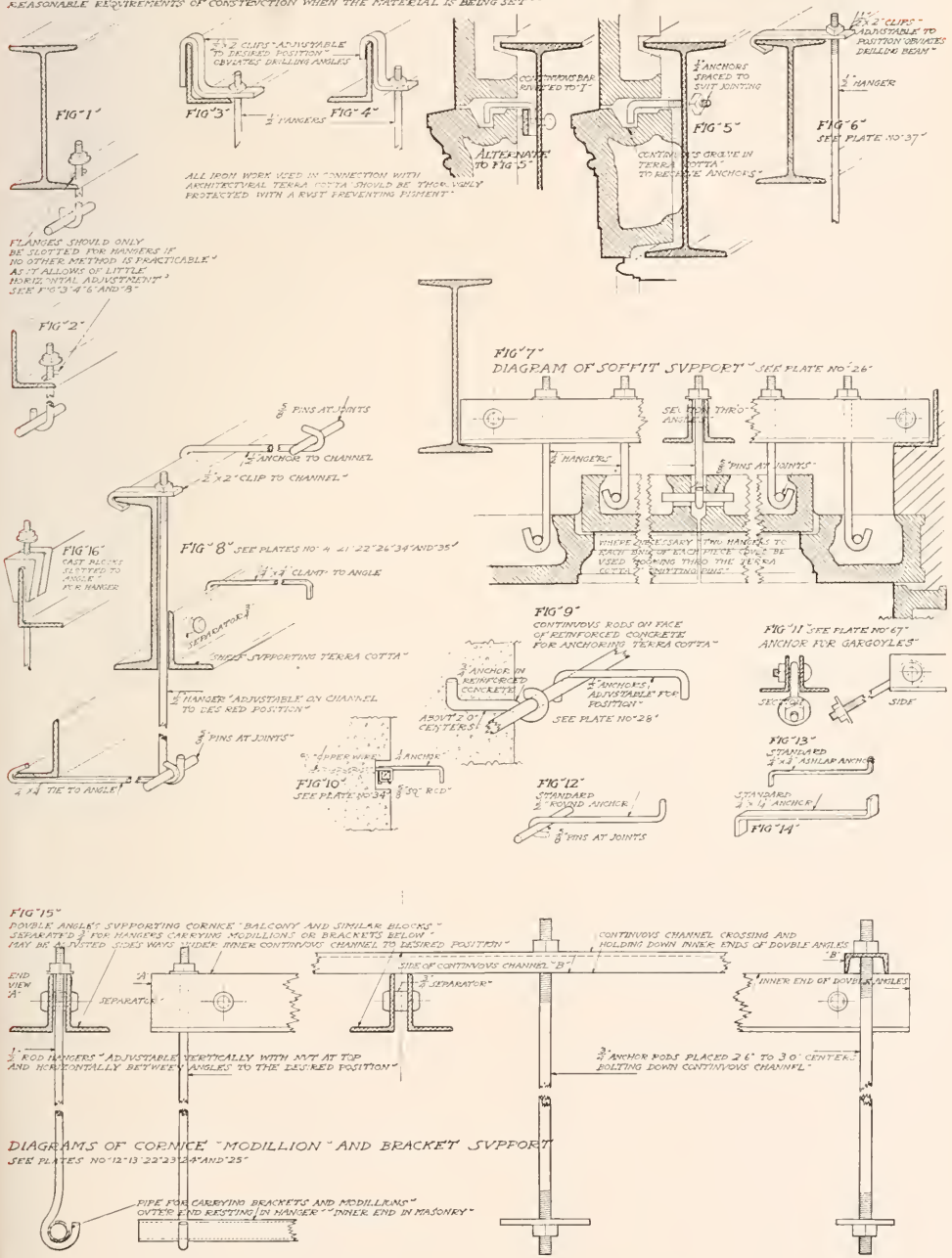




DETAILS OF IRON ANCHORS "HANGERS "STRAPS "CLIPS "ETC"

VSED IN SETTING ARCHITECTVRAL TERRA COTTA"

STRVCTVRAL STEEL" WHEN ERECTED "FREQVENTLY VARIES FROM EXACT FIGVRED DIMENSIONS"" "FOR THIS REASON ALL SVPPORTS FOR TERRA COTTA" INCLVDING ANGLES "RODS "ANCHORS "ETC" SHOVLD BE DESIGNED SO AS TO PERMIT OF EASY ADJVSTMENT TO THE REASONABLE REQVIREMENTS OF CONSTRVCTION WHEN THE MATERIAL IS BEING SET""



We are indebted to the National Terra Cotta Society for the admirable details given above of practical methods of supporting terra cotta, covering most of the conditions which are likely to occur in the general construction where terra cotta is involved.—Editor.

TABLE OF TREADS AND RISES.

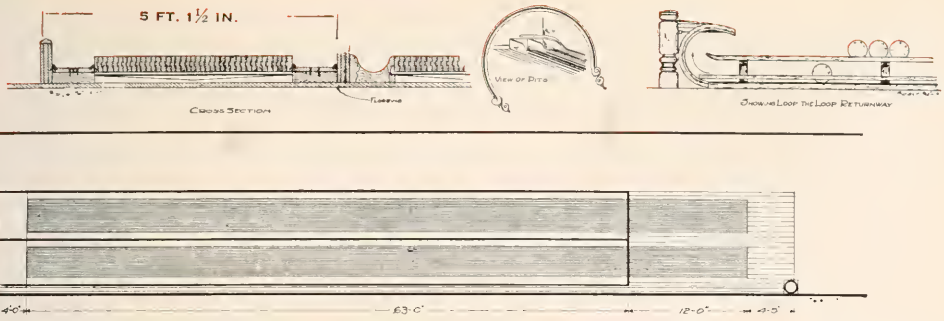
No. of Treads.	6 Inch Rise. ft.	in.	6¼ Inch Rise. ft.	in.	6½ Inch Rise. ft.	in.	6¾ Inch Rise. ft.	in.	7 Inch Rise. ft.	in.	7⅛ Inch Rise. ft.	in.
1		6		6¼		6½		6¾		7		7⅛
2	1	0	1	0½	1	1	1	1½	1	2	1	2¼
3	1	6	1	6¾	1	7½	1	8¼	1	9	1	9⅜
4	2	0	2	1	2	2	2	3	2	4	2	4½
5	2	6	2	7¼	2	8½	2	9¾	2	11	2	11⅝
6	3	0	3	1½	3	3	3	4½	3	6	3	6¾
7	3	6	3	7¾	3	9½	3	11¼	4	1	4	1⅞
8	4	0	4	2	4	4	4	6	4	8	4	9
9	4	6	4	8¼	4	10½	5	0¾	5	3	5	4⅛
10	5	0	5	2½	5	5	5	7½	5	10	5	11¼
11	5	6	5	8¾	5	11½	6	2¼	6	5	6	6⅜
12	6	0	6	3	6	6	6	9	7	0	7	1½
13	6	6	6	9¼	7	0½	7	3¾	7	7	7	8⅝
14	7	0	7	3½	7	7	7	10½	8	2	8	3¾
15	7	6	7	9¾	8	1½	8	5¼	8	9	8	10⅞
16	8	0	8	4	8	8	9	0	9	4	9	6
17	8	6	8	10¼	9	2½	9	6¾	9	11	10	1⅛
18	9	0	9	4½	9	9	10	1½	10	6	10	8¼
19	9	6	9	10¾	10	3½	10	8¼	11	1	11	3⅜
20	10	0	10	5	10	10	11	3	11	8	11	10½
21	10	6	10	11¼	11	4½	11	9¾	12	3	12	5⅝
22	11	0	11	5½	11	11	12	4½	12	10	13	0¾
23	11	6	11	11¾	12	5½	12	11¼	13	5	13	7⅞
24	12	0	12	6	13	0	13	6	14	0	14	3
25	12	6	13	0¼	13	6½	14	0¾	14	7	14	10⅛
26	13	0	13	6½	14	1	14	7½	15	2	15	5¼
27	13	6	14	0¾	14	7½	15	2¼	15	9	16	0⅜
28	14	0	14	7	15	2	15	9	16	4	16	7½
29	14	6	15	1¼	15	8½	16	3¾	16	11	17	2⅝
30	15	0	15	7½	16	3	16	10½	17	6	17	9¾

No. of Treads.	7¼ Inch Rise. ft.	in.	7⅜ Inch Rise. ft.	in.	7½ Inch Rise. ft.	in.	7⅝ Inch Rise. ft.	in.	7¾ Inch Rise. ft.	in.	7⅞ Inch Rise. ft.	in.	8 Inch Rise. ft.	in.	8¼ Inch Rise. ft.	in.
1		7¼		7⅜		7½		7⅝		7¾		7⅞		8		8¼
2	1	2½	1	2¾	1	3	1	3¼	1	3½	1	3¾	1	4	1	4½
3	1	9¾	1	10⅛	1	10½	1	10⅞	1	11¼	1	11⅝	2	0	2	0¾
4	2	5	2	5½	2	6	2	6½	2	7	2	7½	2	8	2	9
5	3	0¼	3	0⅞	3	1½	3	2⅛	3	2¾	3	3⅜	3	4	3	5¼
6	3	7½	3	8¼	3	9	3	9¾	3	10½	3	11¼	4	0	4	1½
7	4	2¾	4	3⅝	4	4½	4	5⅜	4	6¼	4	7⅛	4	8	4	9¾
8	4	10	4	11	5	0	5	1	5	2	5	3	5	4	5	6
9	5	5¼	5	6⅜	5	7½	5	8⅝	5	9¾	5	10⅞	6	0	6	2¼
10	6	0½	6	1¾	6	3	6	4¼	6	5½	6	6¾	6	8	6	10½
11	6	7¾	6	9⅛	6	10½	6	11⅞	7	1¼	7	2⅝	7	4	7	6¾
12	7	3	7	4½	7	6	7	7½	7	9	7	10½	8	0	8	3
13	7	10¼	7	11⅞	8	1½	8	3⅛	8	4¾	8	6⅜	8	8	8	11¼
14	8	5½	8	7¼	8	9	8	10¾	9	0½	9	2¼	9	4	9	7½
15	9	0¾	9	2⅝	9	4½	9	6⅜	9	8¼	9	10⅛	10	0	10	3¾
16	9	8	9	10	10	0	10	2	10	4	10	6	10	8	11	0
17	10	3¼	10	5⅜	10	7½	10	9⅝	10	11¾	11	1⅞	11	4	11	8¼
18	10	10½	11	0¾	11	3	11	5¼	11	7½	11	9¾	12	0	12	4½
19	11	5¾	11	8⅛	11	10½	12	0⅞	12	3¼	12	5⅝	12	8	13	0¾
20	12	1	12	3½	12	6	12	8½	12	11	13	1½	13	4	13	9
21	12	8¼	12	10⅞	13	1½	13	4⅛	13	6¾	13	9⅜	14	0	14	5¼
22	13	3½	13	6¼	13	9	13	11¾	14	2½	14	5¼	14	8	15	1½
23	13	10¾	14	1⅝	14	4½	14	7⅜	14	10¼	15	1⅛	15	4	15	9¾
24	14	6	14	9	15	0	15	3	15	6	15	9	16	0	16	6
25	15	1¼	15	4⅜	15	7½	15	10⅝	16	1¾	16	4⅞	16	8	17	2¼
26	15	8½	15	11¾	16	3	16	6¼	16	9½	17	0¾	17	4	17	10½
27	16	3¾	16	7⅛	16	10½	17	1⅞	17	5¼	17	8⅝	18	0	18	6¾
28	16	11	17	2½	17	6	17	9½	18	1	18	4½	18	8	19	3
29	17	6¼	17	9⅞	18	1½	18	5⅛	18	8¾	19	0⅜	19	4	19	11¼
30	18	1½	18	5¼	18	9	19	0¾	19	4½	19	8¼	20	0	20	7½

No. of Treads.	8½ Inch Rise. ft.	in.	9 Inch Rise. ft.	in.	9½ Inch Rise. ft.	in.	10 Inch Rise. ft.	in.	10½ Inch Rise. ft.	in.	11 Inch Rise. ft.	in.	13 Inch Rise. ft.	in.	14 Inch Rise. ft.	in.
1		8½		9		9½		10		10½		11	1	1	1	2
2	1	5	1	6	1	7	1	8	1	9	1	10	2	2	2	4
3	2	1½	2	3	2	4½	2	6	2	7½	2	9	3	3	3	6
4	2	10	3	0	3	2	3	4	3	6	3	8	4	4	4	8
5	3	6½	3	9	3	11½	4	2	4	4½	4	7	5	5	5	10
6	4	3	4	6	4	9	5	0	5	3	5	6	6	6	7	0
7	4	11½	5	3	5	6½	5	10	6	1½	6	5	7	7	8	2
8	5	8	6	0	6	4	6	8	7	0	7	4	8	8	9	4
9	6	4½	6	9	7	1½	7	6	7	10½	8	3	9	9	10	6
10	7	1	7	6	7	11	8	4	8	9	9	2	10	10	11	8
11	7	9½	8	3	8	8½	9	2	9	7½	10	1	11	11	12	10
12	8	6	9	0	9	6	10	0	10	6	11	0	13	0	14	0
13	9	2½	9	9	10	3½	10	10	11	4½	11	11	14	1	15	2
14	9	11	10	6	11	1	11	8	12	3	12	10	15	2	16	4
15	10	7½	11	3	11	10½	12	6	13	1½	13	9	16	3	17	6
16	11	4	12	0	12	8	13	4	14	0	14	8	17	4	18	8
17	12	0½	12	9	13	5½	14	2	14	10½	15	7	18	5	19	10
18	12	9	13	6	14	3	15	0	15	9	16	6	19	6	21	0
19	13	5½	14	3	15	0½	15	10	16	7½	17	5	20	7	22	2
20	14	2	15	0	15	10	16	8	17	6	18	4	21	8	23	4
21	14	10½	15	9	16	7½	17	6	18	4½	19	3	22	9	24	6
22	15	7	16	6	17	5	18	4	19	3	20	2	23	10	25	8
23	16	3½	17	3	18	2½	19	2	20	1½	21	1	24	11	26	10
24	17	0	18	0	19	0	20	0	21	0	22	0	26	0	28	0
25	17	8½	18	9	19	9½	20	10	21	10½	22	11	27	1	29	2
26	18	5	19	6	20	7	21	8	22	9	23	10	28	2	30	4
27	19	1½	20	3	21	4½	22	6	23	7½	24	9	29	3	31	6
28	19	10	21	0	22	2	23	4	24	6	25	8	30	4	32	8
29	20	6½	21	9	22	11½	24	2	25	4½	26	7	31	5	33	10
30	21	3	22	6	23	9	25	0	26	3	27	6	32	6	35	0

RULE FOR CALCULATING PROPORTIONED WIDTH AND HEIGHT OF TREADS AND RISES OF STAIRS.

Subtract the width of tread from 25 in. and the result will be twice the height of the riser. Thus: if the tread is 10 in. wide, then $25 - 10 = 15 \div 2 = 7\frac{1}{2}$ in., the height or riser proportionate to a 10-inch tread. This is exclusive of nosings.



SPACE OCCUPIED BY AUTOMOBILES.

Touring Car.

Length, 13 ft. 6 in. to 14 ft.
Height, 7 ft. 3 in.
Width, 6 ft. 0 in.
Smallest practical door, 8 ft. 0 in. by 8 ft. 0 in.

Heavy Trucks.

Length, 13 ft. to 15 ft.
Width, 6 ft. 0 in.
Height, 10 ft. 0 in.
Width on floor between wheel pockets, 48 in.
Height of wheel pocket, 7 in.
Smallest practical door, 9 ft. 0 in. by 11 ft. 0 in.
Doors to alley should not be less than 12 ft. wide.

Moving Vans.

Length, 13 ft. to 16 ft. 6 in.
Width, 7 ft. to 8 ft. 2 in.
Height, 10 ft. to 12 ft.
Smallest practical door 10 ft. 0 in. by 13 ft. 6 in.

CLEARANCE UNDER OLD ELEVATED RAILWAY STRUCTURES AND TROLLEY WIRES, 12 FT. 9 IN.

Clearance required by the city for steam roads, 13 ft. 6 in.

Architects will be perfectly safe in making the maximum limit of door heights for any sort of vehicle 13 ft. 6 in., standard subway height, as no vehicle can be used commercially on the streets of Chicago that will not clear steam road subways. They might go around elevated subways, but they can not go around steam road subways and there is a probability that any future elevated subways would be raised to the city standard height of 13 ft. 6 in.

FURNITURE DIMENSIONS.

FILE 728.942

Chairs—Height of seat, 18″; depth of seat, 19″; top of back, 38″; arms, 9″ above seat.

Lounge—6′ long, 30″ wide.

Tables—Writing, height, 2′-5″; sideboards, height, 3′-0″; general height, 2′-6″.

Note—The smallest size practical for knee holes, 2′ high by 1′-8″ wide.

Beds—Single, width, 3′ to 4′; ¾ bed, width, 4′; double bed, width, 4′-6″ to 5′-0″, length 6′-6″ to 6′-8″; standard double bed, 4′-6″ x 6′-6″; footboards, 2′-6″ to 3′-6″ high; headboards, 5′ to 6′-6″.

Bureaus—Common, width, 3′-5″ or 4′; depth, 1′-6″ or 1′-8″; height, 2′-6″ or 3′.

Commodes—Top, 1′-6″ square and 2′-6″ high.

Chiffoniers—3′ wide, 1′-8″ deep, 4′-4″ high.

Cheval Glasses—Height, 6′-4″ or 5′-0″ or 5′-2″; width, 3′-2″ or 2′-6″ or 1′-8″.

Washstands—Length, 3′-0″; width, 1′-6″; height, 2′-7″.

Wardrobes—Length, 4′-6″—3′-0″; depth, 2′-0″—1′-5″; height, 8′-0″.

Sideboards—Length, 5′ to 6′; depth, 2′-2″.

Pianos—Upright, length, 4′-10″ to 5′-6″; height, 4′-4″ to 4′-9″; depth, 2′-4″. Square, length, 6′-8″; depth, 3′-4″.

Billiard Tables—4′-8″, 4½″ x 9, 5′ x 10. Must have 16′ x 20′ space.

Wardrobe Shelves—5′-10″ high.

Coat Hooks—5′-6″ high.

Flour Barrel—28″ to 30″ high and 20″ to 21″ dia.

DATA ON BUILDINGS WITH SIDINGS.

Clearance from face of building to center of track, 7′-0″.

Height of loading decks:
For shipping, 4′-0″.
For receiving, 3′-0″.

Clearance from center of track to edges of loading decks:
Upper edge, 7′-0″.
Lower edge, 5′-0″.

FILE 728

Spec. No.	No. of Stops.	From Back to Front Line of Case.	Width of Space Required.	Height Required for Swell-Box and Large Pipes.
5	10	7′ 4″	11′ 6″	12′ 6″
7	11	8′	11′ 6″	12′ 6″
8	12	8′	12′ 6″	12′ 6″
10	13	8′ 7″	12′ 6″	12′ 6″
11	14	9′ 3″	12′ 6″	12′ 6″
13	16	10′ 5″	12′ 6″	12′ 6″
14	17	11′	14′ 8″	17′
16	18	11′ 7″	14′ 8″	17′
17	19	12′ 2″	14′ 8″	17′
19	20	12′ 9″	14′ 8″	17′
20	21	12′ 9″	15′ 6″	17′
22	22	13′ 4″	15′ 6″	17′
23	23	13′ 6″	15′ 6″	17′
25	24	14′	15′ 6″	17′
26	25	14′ 6″	15′ 6″	17′
28	26	14′ 6″	15′ 6″	17′
29	27	14′ 6″	16′ 4″	17′ 6″
31	28	15′	16′ 4″	17′ 6″
32	29	15′ 6″	16′ 4″	17′ 6″
34	30	15′ 6″	17′	17′ 6″

Add 40″ more from Front Line of Case for Keydesk Pedals and Seat.

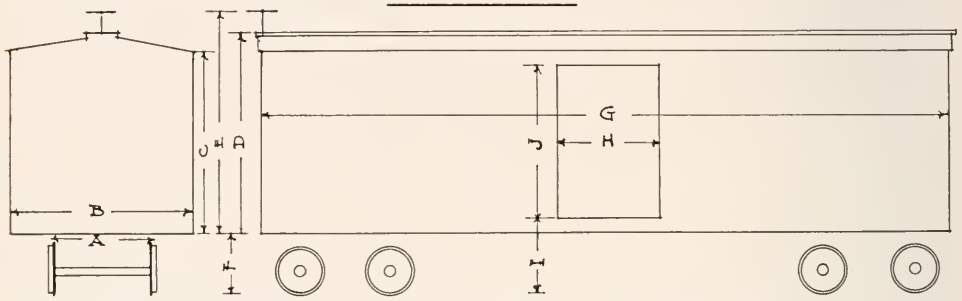
Sizes of Piano.

7⅓ Octaves.

	Height.	Length.	Width.
Upright	about 4 ft. 3 in.	5 ft. 4 in.	2 ft. 3 in.
Small or Baby Grand	about 3 ft. 2 in.	6 ft. 0 in.	4 ft. 10 in.
Parlor Grand	about 3 ft. 2 in.	7 ft. 6 in.	5 ft. 0 in.

SIZES OF FREIGHT CARS.

In response to the numerous requests of architects that we give information as to car and track sizes, etc., essential to the proper planning of buildings where car service is required, we have taken measures of a number of different cars and present below a diagram indicating dimensions of same which we hope to be sufficiently general to meet the architect's needs. It will be noted that there is a wide variation in the size of cars designed for various purposes and built by the different roads.



Car.	A	B	C	D	E	F	G	H	I	J
North-Western	59″	9′-0″	9′- 4″	10′- 4″	10′-10″	38″	34′- 0″	60″	49″	7′-6″
Chicago & Alton	"	9′-3″	9′- 0″	10′- 6″	11′- 0″	36″	40′- 6″	72″	48″	7′-8″
New York Central	"	9′-3″	9′- 2″	10′- 2″	10′-10″	42″	36′- 6″	72″	48″	8′-0″
Baltimore & Ohio	"	9′-4″	8′-10″	9′-10″	10′- 6″	37″	36′- 6″	72″	42″	7′-7″
Pacific Fruit Express	"	9′-3″	9′- 0″	9′-10″	10′- 3″	40″	33′- 9″	48″	50″	6′-2″
North-Western Furniture	"	9′-6″	10′- 6″	11′- 6″	12′- 0″	30″	50′- 6″	144″	40″	9′-8″
Cotton Belt	"	9′-3″	9′- 6″	10′- 6″	11′- 6″	38″	36′- 6″	62″	48″	7′-8″
Chicago & Alton	"	9′-2″	8′- 8″	9′- 8″	10′-11″	37″	34′- 8″	66″	47″	6′-8″
North-Western	"	9′-4″	9′- 2″	10′- 2″	11′- 2″	39″	36′- 6″	60″	49″	7′-6″
North-Western	"	9′-2″	8′- 5″	9′- 6″	10′- 7″	36″	34′- 6″	60″	46″	6′10″
Erie	"	9′-6″	8′- 8″	9′- 8″	10′-10″	40″	34′-10″	62″	50″	6′10″

Quoting from Bulletin No. 119, the American Engineering and Maintenance of Ways Association, issued in January, 1910, we find they recommend that the cross section of single track tunnels shall be 12′ in width, 16′ in height from the top of ties to the spring of arch and the arch to have a radius of 8′, making the distance from top of ties to top of arch 20′ and the ballast extend for a distance of 2′ below the top of ties which they designate as sub-grade. Apparently this would indicate that it is undesirable to locate the walls or columns of a building closer than 8′ from the center of a track, in order to prevent the crushing of a person caught between the track and the walls. The committee reports under "Rules for Roundhouse Construction" that turntables should not be less than 75′ feet in length; that length of stalls for engines should not be less than 85′ clear, in length; that the clear opening of entrance doors should not be less than 13′ in width and 16′ in height, which would indicate that straight tracks can be placed 13′ from centers. Allowance, however, should be made for clearance of projection of car beyond trucks at curves. The old rules permitted entrance doors to be reduced to 12′ in width. Increased size in cars account for new recommendation.

Size of Swimming Tank.

FILE 725.74

Swimming tanks that can be used for swimming contests must be exactly 20 yards in interior length, no less. (A tank ½ inch short would be ruled out of contest.) Eight yards wide is best, although 7 yards will pass; 4 feet deep at shallowest point and 8 feet deep at deepest point, which deepest point should be about 12 feet from end where springboard is placed. Depth at springboard end should be six feet. Interior of tank, both sides and bottom, should be white, and there should be three black lines on the bottom extending parallel with sides, and dividing the tank into four equal alleys; there should be a line across tank on bottom and up sides at exactly 2 yards from each end, measured horizontally, making lines exactly 16 yards apart horizontally.

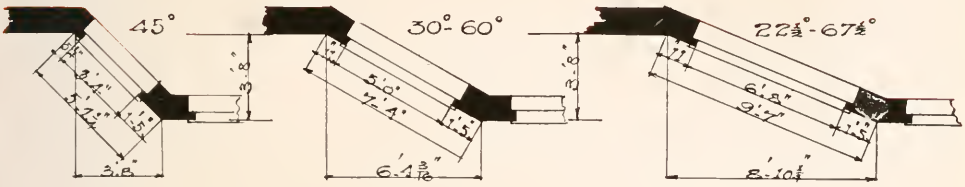
Size of the Billiard Room, Gas Light, Etc.

The space required for the different sized tables is as follows:

For table 6 x 12, Room should be 16 x 22
For table 5½ x 11, Room should be 15½ x 21
For table 5 x 10, Room should be 15 x 20
For table 4½ x 9, Room should be 14 x 18½
For table 4 x 8, Room should be 13 x 17
For table 3½ x 7, Room should be 12½ x 16

The following directions for arranging the lights over billiard tables will be found useful. The distance of the light from the floor should be about 6 feet 2 inches. For a 5½ by 11 table, cross-arms 31 inches and long arms 62 inches. For a 5 by 10 table, the cross-arms of the pendant should measure, from light to light, 28 inches and the long arm 56 inches. For a 4½ by 9 table, cross-arms 25 inches and long arms 50 inches. For a 4 by 8 table, cross-arms 22 inches and long arms 44 inches.

Table Showing the Length of Sides of Bays, Angle being 45, 30-60 and 22½-67½ Degrees.



Examples.

Angle of 45 Degrees.

1	ft.	6	in.	by	1	ft.	6	in.	2	ft.	1 7/16	in.	2	ft.	10	in.	by	2	ft.	10	in.	4	ft.	0 1/16	in.
1	"	7	"	"	1	"	7	"	2	"	2 7/8	"	2	"	11	"	"	2	"	11	"	4	"	1 1/2	"
1	"	8	"	"	1	"	8	"	2	"	4 1/4	"	3	"	0	"	"	3	"	0	"	4	"	2 1/16	"
1	"	9	"	"	1	"	9	"	2	"	5 1/16	"	3	"	1	"	"	3	"	1	"	4	"	4 3/16	"
1	"	10	"	"	1	"	10	"	2	"	7 1/4	"	3	"	2	"	"	3	"	2	"	4	"	5 3/4	"
1	"	11	"	"	1	"	11	"	2	"	8 1/2	"	3	"	3	"	"	3	"	3	"	4	"	7 1/8	"
2	"	0	"	"	2	"	0	"	2	"	9 1/16	"	3	"	4	"	"	3	"	4	"	4	"	8 5/16	"
2	"	1	"	"	2	"	1	"	2	"	11 3/8	"	3	"	5	"	"	3	"	5	"	4	"	10	"
2	"	2	"	"	2	"	2	"	3	"	0 3/4	"	3	"	6	"	"	3	"	6	"	4	"	11 3/8	"
2	"	3	"	"	2	"	3	"	3	"	2 3/16	"	3	"	7	"	"	3	"	7	"	5	"	1 5/16	"
2	"	4	"	"	2	"	4	"	3	"	3 5/8	"	3	"	8	"	"	3	"	8	"	5	"	2 1/4	"
2	"	5	"	"	2	"	5	"	3	"	5	"	3	"	9	"	"	3	"	9	"	5	"	3 5/8	"
2	"	6	"	"	2	"	6	"	3	"	6 7/16	"	3	"	10	"	"	3	"	10	"	5	"	5 1/16	"
2	"	7	"	"	2	"	7	"	3	"	7 7/8	"	3	"	11	"	"	3	"	11	"	5	"	6 1/2	"
2	"	8	"	"	2	"	8	"	3	"	9 1/4	"	4	"	0	"	"	4	"	0	"	5	"	7 7/8	"
2	"	9	"	"	2	"	9	"	3	"	10 11/16	"													

Angle of 30-60 Degrees.

1	ft.	6	in.	by	2	ft.	7 3/16	in.	3	ft.	0	in.	2	ft.	10	in.	by	4	ft.	10 7/8	in.	5	ft.	8	in.
1	"	7	"	"	2	"	8 1/8	"	3	"	2	"	2	"	11	"	"	5	"	0 5/8	"	5	"	10	"
1	"	8	"	"	2	"	10 5/8	"	3	"	4	"	3	"	0	"	"	5	"	2 3/8	"	6	"	0	"
1	"	9	"	"	3	"	0 3/4	"	3	"	6	"	3	"	1	"	"	5	"	4 1/16	"	6	"	2	"
1	"	10	"	"	3	"	2 1/8	"	3	"	8	"	3	"	2	"	"	5	"	5 1/16	"	6	"	4	"
1	"	11	"	"	3	"	3 1/8	"	3	"	10	"	3	"	3	"	"	5	"	7 9/16	"	6	"	6	"
2	"	0	"	"	3	"	5 9/16	"	4	"	0	"	3	"	4	"	"	5	"	9 1/16	"	6	"	8	"
2	"	1	"	"	3	"	7 5/16	"	4	"	2	"	3	"	5	"	"	5	"	11	"	6	"	10	"
2	"	2	"	"	3	"	9 1/16	"	4	"	4	"	3	"	6	"	"	6	"	0 3/4	"	7	"	0	"
2	"	3	"	"	3	"	10 3/4	"	4	"	6	"	3	"	7	"	"	6	"	2 1/2	"	7	"	2	"
2	"	4	"	"	4	"	0 1/2	"	4	"	8	"	3	"	8	"	"	6	"	4 3/16	"	7	"	4	"
2	"	5	"	"	4	"	2 1/4	"	4	"	10	"	3	"	9	"	"	6	"	5 15/16	"	7	"	6	"
2	"	6	"	"	4	"	3 15/16	"	5	"	0	"	3	"	10	"	"	6	"	7 11/16	"	7	"	8	"
2	"	7	"	"	4	"	5 11/16	"	5	"	2	"	3	"	11	"	"	6	"	9 7/16	"	7	"	10	"
2	"	8	"	"	4	"	7 7/16	"	5	"	4	"	4	"	0	"	"	6	"	11 1/8	"	8	"	0	"
2	"	9	"	"	4	"	9 3/16	"	5	"	6	"													

Angle of 22½-67½ Degrees.

1	ft.	6	in.	by	3	ft.	7 7/16	in.	3	ft	11	in.	2	ft.	10	in.	by	9	ft.	10 1/16	in.	7	ft.	4 13/16	in.
1	"	7	"	"	3	"	9 7/8	"	4	"	1 5/8	"	2	"	11	"	"	7	"	0 1/2	"	7	"	7 1/8	"
1	"	8	"	"	4	"	0 5/16	"	4	"	4 5/16	"	3	"	0	"	"	7	"	2 1/16	"	7	"	10 1/16	"
1	"	9	"	"	4	"	2 11/16	"	4	"	6 7/8	"	3	"	1	"	"	7	"	5 5/16	"	8	"	0 11/16	"
1	"	10	"	"	4	"	5 1/8	"	4	"	9 1/2	"	3	"	2	"	"	7	"	7 3/4	"	8	"	3 5/16	"
1	"	11	"	"	4	"	7 1/2	"	5	"	0 1/8	"	3	"	3	"	"	7	"	10 1/4	"	8	"	5	"
2	"	0	"	"	4	"	9 15/16	"	5	"	2 11/16	"	3	"	4	"	"	8	"	0 9/16	"	8	"	8 1/2	"
2	"	1	"	"	5	"	0 3/8	"	5	"	5 3/8	"	3	"	5	"	"	8	"	3	"	8	"	11 1/8	"
2	"	2	"	"	5	"	2 3/4	"	5	"	7 15/16	"	3	"	6	"	"	8	"	5 3/8	"	9	"	1 3/4	"
2	"	3	"	"	5	"	5 3/16	"	5	"	10 9/16	"	3	"	7	"	"	8	"	7 13/16	"	9	"	4 3/8	"
2	"	4	"	"	5	"	7 5/8	"	6	"	1 3/16	"	3	"	8	"	"	8	"	10 1/4	"	9	"	7	"
2	"	5	"	"	5	"	10	"	6	"	3 11/16	"	3	"	9	"	"	9	"	0 5/8	"	9	"	9 9/16	"
2	"	6	"	"	6	"	0 7/16	"	6	"	6 3/8	"	3	"	10	"	"	9	"	3 1/16	"	10	"	0 3/16	"
2	"	7	"	"	6	"	2 13/16	"	6	"	9	"	3	"	11	"	"	9	"	5 7/16	"	10	"	2 13/16	"
2	"	8	"	"	6	"	5 1/4	"	6	"	11 5/8	"	4	"	0	"	"	9	"	9 7/8	"	10	"	5 7/16	"
2	"	9	"	"	6	"	7 11/16	"	7	"	2 1/4	"													

ESTIMATE DATA

ESTIMATE BY CUBE

In April, this year, thirty-three letters were addressed to prominent architects of this city asking the below quoted questions relative to methods of estimating by cube. These letters were sent out for the purpose of determining whether there existed any uniform practice as to methods of measurement for determining cubic contents in cases where estimates are made on cubic basis.

We give below tabulation of replies received, the numbers above columns corresponding to the numbers of paragraphs answered in said columns, and the numbers at the side of tabulation giving the designating number of the architect's reply. The names of the architects replying are withheld as agreed. It is sufficient to say that the thirty-three architects sent to are probably the architects for more than 50 per cent of the entire value of all buildings erected in Chicago during the last year. Dashes are placed opposite questions not answered:

"In figuring the cubic contents of buildings to be used in preparing approximate estimates of the cost of same, do you estimate the height from

1, the bottom of spread foundations or footings to the average height of roof;
2, the underside of basement floor to average height of roof;
3, one-half the average depth of spread footings to the mean height of roof;
4, the top of basement floor to the top of roof;
5, the bottom of spread foundations to the top of parapet wall.
6, In the case of pitched roof building do you measure to one-half the height of pitched roof; or to two-thirds the height of pitched roof; or to one-fourth the height of pitched roof?
7, In the case of buildings having caisson foundations do you figure cubic contents from the top of caisson foundation and estimate the value of caisson foundation independently?
8, Or do you figure a certain per cent of the supposed height of caisson foundation as added to the height of building?
9, What do you consider from your experience, using your method of figuring, to be the approximate cost per cubic foot of the average commercial fireproof Office Building, twelve stories or over in height on caisson foundation with an ordinary face brick exterior and limited amount of terra cotta trimming?
10, What do you consider from your experience, using your method of figuring, to be the approximate cost per cubic foot for the average fireproof commercial Storage Warehouse intended for the storage of household furniture, etc.?
11, Same conditions as above, except Mill constructed with sprinkler system?
12, What do you consider from your experience, using your method of figuring, to be the approximate cost per cubic foot of the average fireproof commercial Loft Building, on a corner lot having 75-foot frontage or more on front street and the full depth of lot on the side street?
13, Same conditions as above except Mill constructed with sprinkler system?
14, What do you consider from your experience, using your method of figuring, to be the approximate cost per cubic foot of the average fireproof commercial Department Store Building, eight stories or more in height, not less than 100-foot frontage on front street and full depth of lot on side street, the average floor loads 150 pounds to the square foot and with the average floor loads 250 pounds to the square foot?
15, What do you consider from your experience, using your method of figuring, to be the approximate cost per cubic foot of the average commercial Apartment Building, where the apartments rent at a rate of

16, $15.00 per room?
17, $10.00 per room?
18, $ 8.00 per room?
19, $ 6.00 per room?
20, $ 5.00 per room?
21, $ 4.00 per room?

Where the term "commercial" is used in the above questions it is understood to mean that the building contemplated shall be appropriate to the uses described and suitable to bring the rents contemplated. It is not intended to include in these approximations the monumental or special building, but it is intended that where rents are indicated as high that the finish, construction and arrangement shall give the value usually given for the rent named, assuming that the lot is appropriate to the improvement."

Arch	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1				yes		½ ht.	yes	no	—	13 to 15¢ former 11¢	—	—	—	—	—	20¢ to 22¢	17¢	16½¢	—	—	—
2	Promised to reply later																				
3	yes					½ ht.	yes	no	35	—	—	12½ to 17¢	10¢	—	—	25¢	20¢	18¢	—	—	—
4		yes				exact cost	"	"	—	—	—	—	—	25 to 35¢	—	—	—	—	—	—	—
5			yes			½ ht.	"	"	35 to 40¢	8½ to 10¢	8 to 10¢	15 to 20 20-30	12 to 18¢	—	—	—	—	—	—	—	—
6				yes		"	"	"	30 to 35¢	10 to 12¢	10 to 11¢	10 to 11¢	10 to 11¢	20¢ up	21¢ up	—	—	—	—	—	—
7	yes					"	"	"	26 to 30¢	12¢	10¢	14¢	12¢	15¢	—	—	—	—	—	—	—
8				yes		⅓ ht.	"	"	30 to 35¢	12¢	10½¢	13 to 14¢	10 to 11½¢	—	—	—	—	—	—	—	—
9	Refused to answer "It would do no good"																				
10					yes	½ ht.	yes	no	25 to 30¢	—	9 to 10¢	13 to 14¢	—	—	—	—	—	—	—	—	—
11					yes		"	"	28 to 34¢	12¢	9 to 11¢	10½ to 13¢	9 to 10¢	15 to 18¢	21 to 22¢	18 to 20¢	17 to 18¢	16 to 17¢	15½	13¢	11¢
12				yes			"	"	—	—	—	—	—	—	—	—	—	—	—	—	—
	2	1	1	4	2		10		31.76	11.55	9.85	15.13	11.35	21⅓	21⅓	21	18	16.87	15½	13	11.

The answers make clear that if the different architects represented in same were called on to estimate the cost per cubic foot of a certain building, with a known total cost, their unit prices per cubic foot would necessarily vary because of the variation in volume produced by diversity in methods of estimating height of building.

To state that one building costs more per cubic foot than another, without stating that the volume has been figured in the same way by the same man is likely to create a false impression.

We were greatly disappointed at the meager response to the letters sent out, but realize with what difficulty busy men find time to attend to extraneous work. **The replies received are sufficiently representative and comprehensive to clearly indicate the wide variation of method of measuring height in estimating by cube.**

MASONRY, PLASTERING AND FIREPROOFING.

Weight of Brickwork

Placing the weight of brickwork at 112 lb. per cubic foot, the weights per superficial foot for different walls are:

9	inch wall	84 lb.
13	inch wall	121 lb.
18	inch wall	168 lb.
22	inch wall	205 lb.
26	inch wall	243 lb.

Measurement of Old Brick

Uncleaned rough from building dumped from 8 to 10 bricks per cubic foot, or average of 111 cubic feet to the M.

Uncleaned stacked on outside and interior of stack filled promiscuously 10-12 per cubic foot, or average of 91 cubic feet to the M.

Cleaned and closely stacked, 16 to 18 bricks per cubic foot, or actual average of 59 cubic feet to M. (Usually sold at 60 cubic feet to M to allow for waste and poor piling.)

Cleaned stacked on outside and interior filled promiscuously, 12 to 14 per cubic foot, or actual average of 77 cubic feet to M. (When sold from pile measure customary to count 80 cubic feet to M, to allow for waste and bats.)

Measurement of New Brick Work.

The Chicago Masons and Builders' Association have arbitrarily assumed that a cubic foot of wall contains 22½ common brick, or 7½ brick to the superficial foot of 4-inch wall and 15 brick to the superficial foot of 8-inch wall. These figures of the Masons' and Builders' Association are frequently used for the appraisal of party walls, etc., but if so used, the price per M for work in wall should be reduced accordingly.

The actual number of Chicago common brick required for a cubic foot of solid wall varies from 17½ to 19½, and masons in purchasing brick usually reserve 18 brick per cubic foot of solid wall; and when so doing, rarely find an excess or shortage at the end of construction. When the walls are divided into many small piers, requiring much cutting, and consequently much waste, it is best to figure 20 brick to the cubic foot.

On account of the wide variance of practice on the part of masons in estimating, architects, when calling for estimates on brick work by the thousand, will avoid useless controversy by stipulating that quantity of brick will be determined by superficial wall measurement according to the following rule, which is very nearly correct, as Chicago brick now run. Divide the total number of superficial feet of wall surface of a given thickness by 160, and multiply the result by the number of brick widths the wall is thick, and the result will equal the number of thousands of brick contained. A four-inch wall will contain 6¾ brick to the superficial foot, or 1,000 brick to 160 square feet.

Miscellaneous Masonry Data.

One hundred yards of plastering will require fourteen hundred laths, four and a half bushels of lime, four-fifths of a load of sand, nine pounds of hair and five pounds of nails, for two-coat work.

A load of mortar measures a cubic yard, requires a cubic yard of sand and nine bushels of lime, and will fill thirty hods.

A bricklayer's hod measuring one foot four inches by nine inches, equals 1,296 cubic inches in capacity, and contains twenty bricks.

A single load of sand or other materials equals a cubic yard.

Cement Mortars. FILE 693.2

S. W. Curtiss, an authority on mortars, states that the only way lime mortar will set is by chemical combination with carbonic acid gas. In common practice this always comes from the atmosphere. Anything excluding air from lime mortar will prevent its setting; for this reason it is detrimental to lay imporous brick in lime mortar as such brick do not conduct air through same to the mortar joint and the only air that can come in contact with the mortar must pass through the mortar itself.

Set by crystallization, which means that in order to set cement must be supplied with water. In consequence cement mortar sometimes fails to set, or harden when used for laying porous brick on account of the fact that capillarity draws all of the moisture out of the mortar into the brick and it does not have sufficient water for crystallization. Porous brick if laid in cement mortar should be thoroughly soaked so as to fill the pores and destroy the tendency to absorb moisture from the mortar. Nearly all stone products if ground fine enough will crystallize when mixed with water forming a cement of greater or less strength according to the character of the material and the fineness of the grinding. Calcareous matters or Portland cement which will not pass a 100 mesh sieve are incapable of crystallization and therefore valueless as a cementing material. The introduction of sand or stone products in cement not ground so as to pass 100 mesh reduces the amount of cementing material to the volume and at the same time increases its efficiency. A one hundred volume of neat cement that has a tensile strength of 700 pounds to the square inch will, when used with a four hundred volume of properly assorted gravel give a tensile strength of three hundred fifty pounds to the square inch. As there are five square inches the cement holds five times 350 or 1,750. Thus increasing the efficiency of the cement two and one-half times, and at the same time the proper proportion of graded gravels eliminate shrinking or swelling of the mass. While neat cement is stronger per cubic inch than the concrete, it is necessary in practical use to combine it with proper quantity of proper aggregates to avoid craze cracking from shrinkage. The smaller proportion of water in Portland cement making it workable gives the greatest strength. Neat Portland will take 22% of water to make it workable. This is an excess of water needed in the crystallization. In compressing it is impossible to compress the water, causing a shrinkage when crystallization takes place. When Portland cement is used with four volumes of aggregates 8% of the five volumes of water will make a workable material. This can be compressed without the danger of shrinkage. The cement attacks the silica of the aggregates, crystallizing into one mass. The introduction of quick lime into cement mortar means weakening the strength of the mortar way out of proportion to the amount of lime introduced. The effect is much worse than the introduction of an increased amount of sand except that the lime has a slightly retardative effect on the setting of the cement.

Hydrated lime in small quantities is probably less injurious than slacked lime. Cement has a tendency to prevent the setting of lime, by excluding the atmosphere, while lime has a tendency to prevent the setting of cement by absorbing moisture required for crystallization of the cement.

FRAMED AND BOXED CONSTRUCTION CARPENTRY, STRUCTURAL AND ORNAMENTAL IRON.

ESTIMATE DATA FOR ORDINARY STUD AND JOIST CONSTRUCTION.

By EMERY STANFORD HALL, B S.

No hard and fast rule can be laid down for estimating. There are so many practical exigencies which alter assumed or average conditions that experience and judicial capacity are essential to successful estimating. Manifestly a well organized force commanded by men of executive ability can accomplish more and better work in less time and with less waste than a poor organization of inefficient men under incapable direction. Likewise work easily accessible and simple in design can be executed by any force with less waste and in less time than complicated work or work executed at a high altitude, requiring much scaffolding and hoisting apparatus.

FLOOR FRAMING.

The number of joists required is always in excess of the number which would naturally be called for by uniform spacing as indicated in Fig. 1 "Floor Construction, type C." Extra joists have to be put in to form trimmers and headers around chimneys, stair-wells, and other openings in floors. Also, joists should be doubled under partitions with block separators between so as to permit pipes passing through without cutting. These conditions, as illustrated below in Fig. 1, "Type E Floor Construction," show a case where 14 joists are required in only ten uniform spacings, which is extreme, but taking an average of type "E" and type "C," conditions which occur with about equal frequency in buildings of average requirements, it is reasonable to assume that two extra joists will be required for every ten feet.

Number of thousands of board feet in joists for any uniform bent of any building, with any length of joists, when width of bent plus the joist bearing on walls or girders = l; any stretch or depth of the bent parallel to joist bearings = L; any uniform distance between centers of joists = s; and J = the result:—

$$J = \frac{\frac{bdl}{12}}{1000}\left(\frac{2L}{10}+\frac{L}{s}\right)$$

$\frac{bdl}{12}$ = the number of board feet of material in a piece of timber (b) thick by (d) in depth and (l) in length, and the values of same for material most generally used are given in table A.

Let $\frac{bdl}{12}$ = B.

(1.) $J = \frac{B}{1000}\left(\frac{2L}{10}+\frac{L}{s}\right)$. s is commonly equal either to 1 ft. or 1⅓ ft. Substituting 1 for value of s = joists placed 12″ from C.

(2.) $J = .0012\ L\ B$. Substituting 1⅓ for value of s = joists placed 16″ from C.

(3.) $J = .00095\ L\ B$.

(4.) $J = .0008\ L\ B$.

To find the average amount of material contained in a square of 100 sq. ft. floor construction take a value of B corresponding to l = 10, and a value of L = 10 and substitute in either formula (1.), (2.) or (3.) according to spacing desired. The following "Table I" gives the result of such substitution for some of the more commonly used sizes of joists:

TABLE I.

l=10
L=10

Number of M's of bd. ft. in a square of 100 sq. ft. for various joists in construction

b d	$\frac{10\ b\ d}{12}$ = B	J s=1	J s=1⅓	J s=1⅔
2 x 2	3.34	.04008	.03173)	.06720
2 x 4	6.67	.08004	.0633(5	.05336
2 x 6	10.00	.12000	.0950(0	.08000
2 x 8	13.34	.16008	.126730	.10672
2 x 10	16.67	.20004	.158365	.13336
2 x 12	20.00	.24000	.190000	.16000
2 x 14	23.34	.28008	.221730	.18672
2 x 16	26.67	.32004	.253365	.21336
3 x 6	15.00	.18000	.142500	.12000
3 x 8	20.00	.24000	.190000	.16000
3 x 10	25.00	.30000	.237500	.20000
3 x 12	30.00	.36000	.285000	.24000
3 x 14	35.00	.42000	.332500	.28000
3 x 16	40.00	.48000	.380000	.32000
4 x 4	13.34	.16008	.126730	.10672
4 x 6	20.00	.24000	.190000	.16000
4 x 8	26.67	.32004	.233365	.21336
4 x 10	33.34	.40008	.316730	.26672
4 x 12	40.00	.48000	.380000	.32000
4 x 14	46.67	.56004	.443365	.37336
4 x 16	53.34	.64008	.506730	.42672
COL. I	COL. II	COL. III	COL. IV	COL. V

Col. I gives size of joists or sticks of timber. Col. II gives the number of board feet in a stick of the size given in Col. I and 10 ft. long. Col. III gives the amount of M of bd. ft. of framing material contained in a square of 100 sq. ft. for joists of the size given in Col. I when these joists are placed 12″ from centers; Col. IV when placed 16″ from centers; Col. V when placed 20″ from centers.

Bridging where placed 8 ft. on centers requires 12 pairs to the square where joists are placed 12″ from centers; 9⅜ pair where joists are placed 16″ from centers.

PARTITION CONSTRUCTION.

The amount of material and labor involved in the various types of ordinary stud partitions is practically uniform for a given height of partition, spacing of studs and size of same. See types "F" and "G" in illustration below. Type "F" has two layer bottom plate or shoe, 1 line of block-bridging and a single layer top-plate, while type "G" has two layer bottom-plate or shoe and two layer cap-plate with no block-bridging, giving the same actual amount of material. Stud partitions are usually spaced out and studs set on uniform spacing, regardless of openings; then the openings are cut and the studs around same doubled, requiring extra studs, as the posts at sides of openings rarely happen to fall on the line with studs originally placed. Door opening Fig. 1, type "A" is usual condition. Door opening Fig. 1, type "B," where both posts fall in line with studs as first set, is a type which almost never occurs in actual practice and so cannot be considered as a possible saving on material. "Section AA," Fig. 1, shows connecting partitions from various directions and makes clear the necessity for extra studs above the number required for regular spacing to provide for angles. It will be seen that every angle requires from 2 to 4 extra studs. The pieces of studs cut out for openings are used for doubling, but there are not sufficient to supply all extra studding needed.

Number of thousands of board feet in studs for any partition with any length of studs, when length of studs between shoe and cap-plate = h; any length of partition measured in the horizontal direction and through all angles, so as to increase the actual length of partition by the thickness of same at angles = L; any uniform distance between centers of studs = s; and Q = the result:

Observing Fig. 1, it will be seen that average value of $Q = \left[\frac{\left(\frac{L}{s}+\frac{8L}{10}\right)h+4L}{1000}\right]$ ft. $\frac{\text{ft.}}{12 \cdot 14} =$ the number of board feet of material in a piece of timber or stud; (f) face by (t) thickness and one ft. in length and the values of same for sizes of material most generally used are given in Table II, Col. II. Let $\frac{ft}{12} = F$

(5.) $Q = F\left[\frac{\left(\frac{L}{s}+\frac{8L}{10}\right)h+4L}{1000}\right]$. s is commonly equal either to 1 or $1\frac{1}{3}$, sometimes $1\frac{2}{3}$.

Substituting 1′ for value of s = studs place 1 12″ from C.

(6.) $Q = \left(\frac{1.8Lb+4L}{1000}\right)F.$

TABLE II.

Size of studs f x t	L=10 $\frac{ft}{12}=F$	12″ spacing $Q_{h=10}^{s=1}$	16″ spacing $Q_{h=10}^{s=1\frac{1}{3}'}$	20″ spacing $Q_{h=10}^{s=1\frac{2}{3}'}$
1″x 1″	.084	.01848	.016380	.01512
1 x 2	.167	.03674	.03240	.30060
2 x 2	.334	.07348	.06480	.06012
2 x 3	.500	.11000	.09750	.09000
2 x 4	.667	.14674	.11027	.12006
2 x 6	1.000	.22000	.19500	.18000
2 x 8	1.334	.29348	.26013	.24012
3 x 4	1.000	.22000	.19500	.18000
3 x 6	1.500	.33000	.29250	.27000
3 x 8	2.000	.44000	.38000	.36000
4 x 4	1.334	.30448	.26013	.24012
4 x 6	2.000	.440000	.39000	.36000
4 x 8	2.667	.58675	.52007	.48006
COL. I	COL. II	COL. III	COL. IV	COL. V

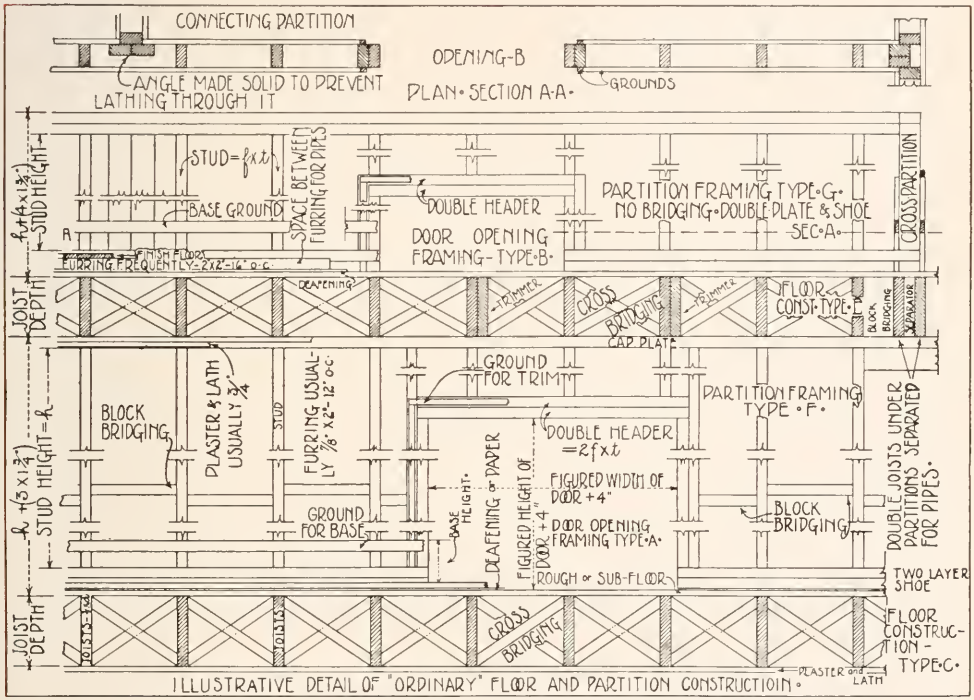


Fig. 1.

Substituting $1\frac{1}{3}$′ for value of s = studs spaced 16″ from c.

(7.) $\left(\frac{1.55Lb+4L}{1000}\right)F.$

Substituting $1\frac{2}{3}$′ for value of s = studs spaced 20″ from c.

(8.) $\left(\frac{1.4Lb+4L}{1000}\right)F.$

To find the average number of M's of bd. ft. of framing material contained in a square of 100 sq. ft. of partition construction take a value of F corresponding to size of studs used (see Col. II, Table II below) and a value of L = 10 and substitute in either formula (5.), (6.), (7.) or (8.), according to spacing desired. This really will give a partition three or four × f greater in one dimension than 10 ft., but this should be allowed extra for places where the material will not cut to advantage. The following Table II gives the result of such substitution for some of the more commonly used sizes of joists. (6.) becomes Q = .22 F; (7.) becomes Q = .195 F; (8.) becomes Q = .18 F.

Col. I gives sizes of studs or furring strips. Col. II gives the number of board feet in a stick of the size given in Col. I and one ft. long. Col. III gives the number of M's of bd. ft. of framing material contained in a square of 100 sq. ft. of stud partition or furring, including extras and waste if constructed of studs of the size indicated in Col. I and spaced 12″ from centers; Col. IV, spaced 16″ from centers; Col. V, spaced 20″ from centers.

Grounds are usually placed for nailing base-boards, dado-caps, and trim around openings. These are sometimes made 1″ x 1″ and sometimes 1″ x 2″ and are put up on both sides of partitions.

Number of thousands of board feet in grounds for a partition of any length and height = G = $\left(\frac{4L+5hO}{1000}\right)$. F when O = the number of openings and can be assumed to average $\frac{L}{10}$:

(9.) $G=\left(\frac{4L+.5Lh}{1000}\right)F.$

For one square L = 10, h = 10, then G = .09 F. Value of F can be substituted from Table II, Col. II.

For 1″ x 1″ grounds G = .00756 M; for 1″ x 2″ G = .01503 M bd. ft.

EXTERIOR WALL CONSTRUCTION.

Frame exterior wall construction is so similar to interior stud partition construction that for purposes of estimating quantity of material to determine cost Table II may be used for estimating this work.

Furring is applied to exterior masonry walls, usually 1″ x 2″ spaced either 12″ or 16″ from centers; similar furring is sometimes applied to the under side of joists to receive lath and also on top of rough floors to afford space for pipes; but here it is frequently 2″ x 2″. Not as much extra furring is actually put into the building as extra studs estimated in Table II, but there is so much waste of this material that amounts given in Table II should be used in estimating.

Coverings of Partitions, Walls, Floors and Ceilings are measured by the surface area of each layer. Most such material is either lapped, matched or otherwise cut to waste, so that the surface area purchased will not cover the same amount of frame surface. This varies with different materials and the following table gives values of the factor W, by which the actual measurement of surfaces must be multiplied to determine the amount of material which must be purchased.

TABLE III.

W = 1 for plain boards laid close.
W = .65 for 1″ x 4″ battens placed 6″ from c.
W = .75 for 1″ x 6″ battens placed 8″ from c.
W = 1.13 for 6″ to 8″ D. and M. flooring or sheathing.
W = 1.19 for 4″ D. and M. flooring or ceiling.
W = 1.25 for 3″ D. and M. flooring or ceiling.
W = 1.34 for 2″ D. and M. flooring.
W = 1.75 for 1½″ D. and M. flooring.
W = 1.30 for 6″ siding 4¼ to weather.
W = 1.38 for 4″ siding 2½ to weather.
W = 1. For most felts and papers as these are usually listed for enough less than the roll actually contains to allow for lapping.

LABOR.

Wages for labor are paid by the hour and are governed by union scales. Let hourly wage = H = 65c in Chicago at this time.

Labor required to place and finish material is usually approximated either by the time required to erect a square of surface of framing for partitions, walls, floors, or of layers of covering, or by the time required to place one M bd. ft. of material or M sq. ft. of surface in the case of sheet coverings. The latter method is the more practical and involves less work in estimating, as these quantities have to be determined in estimating the material.

The following table gives the approximate number of hours it will take an average mechanic to place one thousand (M) board feet or surface feet of material of the various sorts and for various purposes enumerated.

TABLE IV.

Framing Stuff. Hours required to place 1 M.
2″x 3″ studs require 35 hours to place 1 M.
2″ x 4″ and 2″ x 6″ studs require 32 hours to place 1 M.
2″ x 8″ studs require 30 hours to place 1 M.
1″ x 1″ grounds require 83 hours to place 1 M.
1″ x 2″ grounds and furring require 64 hours to place 1 M.
2″ x 2″ grounds and furring require 50 hours to place 1 M.
1″ x 8″ to 10″ sheathing require 30 hours to place 1 M.
1″ x 4″ roof sheathing or slats require 26 hours to place 1 M.
1″ x 6″ roof sheathing or slats require 26 hours to place 1 M.
Shingles laid 4½″ to W. require 5.8 hours to place 1 M.
1000 sq. ft. paper or felt require ¾ hours to place 1 M.
1″ x 8″ and 1″ x 6″ D. & M. sheathing require 25 hours to place 1 M.
1″ x 4″ D. & M. sheathing require 26 hours to place 1 M.
2″ x 4″ and 2″ x 6″ D. & M. sheathing require 20 hours to place 1 M.
3″ x 4″ D. & M. sheathing require 14 hours to place 1 M.
3″ x 6″, 3″ x 8″, 4″ x 4″ and 4″ x 6″ D. & M. sheathing require 16.6 hours to place 1 M.
4″ x 8″ D. & M. sheathing require 15 hours to place 1 M.
1″ x 1½″ and 1″ x 2″ D. & M. hardwood flooring require 66 hours to place 1 M.
1″ x 3″ D. & M. hardwood flooring require 58 hours to place 1 M.
1″ x 4″ D. & M. hardwood flooring require 53 hours to place 1 M.
1¼″ x2″ D. & M. hardwood flooring require 63 hours to place 1 M.
1¼″ x 3″ D. & M. hardwood flooring require 60 hours to place 1 M.
2″ x 4″ and 2″ x 6″ rafters require 33 hours to place 1 M. bd. ft.
2″ x 8″ rafters require 30 hours to place 1 M. bd. ft.
2″ x 6″ and 2″ x 8″ joists require 25 hours to place 1 M. bd. ft.
2″ x 10″ joists require 21.5 hours to place 1 M bd. ft.
2″ x 12″ and 2″ x 14″ joists require 20 hours to place 1 M. bd. ft.
3″ x8″ and 3″ x 10″ joists require 20 hours to place 1 M. bd. ft.
3″ x 12″, 3″ x 14″ and 3″ x 16″ joists require 18 hours to place 1 M. bd. ft.
4″ x 8″ and 4″ x 10″ joists require 20 hours to place 1 M. bd. ft.
4″ x 12″ and 4″ x 14″ joists require 18.7 hours to place 1 M. bd. ft.
4″ x 16″ joists require 16.7 hours to place 1 M. bd. ft.
6″ x 6″ joists require 20 hours to place 1 M. bd. ft.
6″ x 8″ and 6″ x 10″ joists require 18.7 hours to place 1 M. bd. ft.
6″ x 12″ and all stuff up to 16″ x 16″ for joists require 16.7 hours to place 1 M.
4″ x 4″ posts require 23 hours to place 1 M. bd. ft.
6″ x 6″ posts require 20 hours to place 1 M bd. ft.
8″ x 8″ posts require 18 hours to place 1 M. bd. ft.
10″ x 10″, 12″ x 12″, 14″ x 14″ and 16″ x 16″ posts require 16.7 hours to place 1 M. bd. ft.

TRIM OR FINISH.

It is impossible to give any accurate idea of the amount of time required to do this class of work, there are so many conditions that enter into consideration that can not be stipulated in a table.

Openings require in labor to put in blocks, set jambs or frames, place trim, hang doors or windows and put on hardware from 6 to 12 hours, but average in all sorts of work and buildings about 9 hours.

Baseboard, one member, 1000 lin. ft. requires 50 hours to place.

Baseboard, two members, 1000 lin. ft. requires 66 hours to place.

Baseboard, three member, 1000 lin. ft. requires 83 hours to place.

Plate-shelf, 3 part, consisting of shelf, apron and mould, 1000 lin. ft. requires 100 hours to place; add 1-6 hour for each bracket.

Wainscoting, plain beaded D. & M., requires 23 hours to place 1 M. bd. ft.

Paneled Wainscoting from 2′ to 4′ 6″ high requires about 83 hours to place 1000 lin. ft.

Picture Moulding requires about 33 hours to place 1000 lin. ft.

Ceiling Beams, consisting of blocks, 3 sides and 2 to 4 mouldings, require about 250 hours to place 1000 lin. ft.

Seat with back and sides requires about 8 hours to place.

THE ESTIMATE.

The estimate at best can be little more than an intelligent guess based on past experience. One can never be sure that the same conditions will prevail in the job to be executed as have prevailed in the one just completed. No attempt has been made to suggest a method of estimating cost of interior trim or exterior cornice frames, etc.

Estimated Cost of Rough Work, Floors and Roofs = [(**J** taken from Table I × **N,** taken from Table IV × **union wages per hour,** taken from union scale governing in the locality) + **J** × (**price per M of material,** obtained from material dealer at the time of making estimate) + (the following for each layer of covering) $\left(\frac{100W}{1000}\right.$ taken from Table III × price per M of material) + $\left.\left(\frac{100W}{1000} \times N \times H\right)\right]$ times the number of squares of this sort of construction contained in the building.

Estimate for partition work, proceed in same manner as for floor, only substitute from proper table.

Example—Estimate the cost of a 2″ x 4″ stud partition 11 ft. high and 137 ft. long broken around various rooms and having studs placed 16″ from centers and 1″ x 1″ grounds.

Area = 137 × 11 = 1507 sq. ft. = 15.07 squares. Q = .11027 from Table II, Col. IV, **Dealer's price** per **M** = $25.00, **N** 2″ x 4″ studs from Table IV = .5 hr. **H** = $.60. **G** from formulae (9.) = .00756 and **N** from Table IV = 2 hr.; then [(.11027 × $25.00) + (.00756 × $26.00) + (.11027 × .5 × $0.60) + (.00756 × 2 × $0.60)] 15.07 =

STANDARD MEASUREMENT TABLE FOR TIMBER.

FILE 694.0

LENGTH	2×4	2×6	2×8	2×10	2×12	2×14	3×4	3×6	3×8	3×10	3×12	3×14	4×4	4×6	4×8	4×10	4×12	6×6	6×8	6×10	6×12	8×8	8×10	8×12	10×10	10×12	10×14	12×12
6	4	6	8	10	12	14	6	9	12	15	18	21	8	12	16	20	24	18	24	30	36	32	40	48	50	60	70	72
8	5	8	11	13	16	19	8	12	16	20	24	28	11	16	21	27	32	24	32	40	48	43	53	64	67	80	93	96
10	7	10	13	17	20	23	10	15	20	25	30	35	13	20	27	33	40	30	40	50	60	53	67	80	83	100	117	120
12	8	12	16	20	24	28	12	18	24	30	36	42	16	24	32	40	48	36	48	60	72	64	80	96	100	120	140	144
14	9	14	19	23	28	33	14	21	28	35	42	49	19	28	37	47	56	42	56	70	84	75	93	112	117	140	163	168
16	11	16	21	27	32	37	16	24	32	40	48	56	21	32	43	53	64	48	64	80	96	85	107	128	133	160	187	192
18	12	18	24	30	36	42	18	27	36	45	54	63	24	36	48	60	72	54	72	90	108	96	120	144	150	180	210	216
20	13	20	27	33	40	47	20	30	40	50	60	70	27	40	53	67	80	60	80	100	120	107	133	160	167	200	233	240
22	15	22	29	37	44	51	22	33	44	55	66	77	29	44	59	73	88	66	88	110	132	117	147	176	183	220	257	264
24	16	24	32	40	48	56	24	36	48	60	72	84	32	48	64	80	96	72	96	120	144	128	160	192	200	240	280	288
26	17	26	35	43	52	61	26	39	52	65	78	91	35	52	69	87	104	78	104	130	156	139	173	208	217	260	303	312
28	19	28	37	47	56	65	28	42	56	70	84	98	37	56	75	93	112	84	112	140	168	149	187	224	233	280	327	336
30	20	30	40	50	60	70	30	45	60	75	90	105	40	60	80	100	120	90	120	150	180	160	200	240	250	300	350	360
32	21	32	43	53	64	75	32	48	64	80	96	112	43	64	85	107	128	96	128	160	192	171	213	256	267	320	373	384
34	23	34	45	57	68	79	34	51	68	85	102	119	45	68	91	113	136	102	136	170	204	181	227	272	283	340	397	408
36	24	36	48	60	72	84	36	54	72	90	108	126	48	72	96	120	144	108	144	180	216	192	240	288	300	360	420	432
38	26	38	51	63	76	89	38	57	76	95	114	133	51	76	101	127	152	114	152	190	228	203	253	304	317	380	443	456
40	27	40	53	67	80	93	40	60	80	100	120	140	53	80	107	133	160	120	160	200	240	213	267	320	333	400	467	480
42	28	42	56	70	84	98	42	63	84	105	126	147	56	84	112	140	168	126	168	210	252	224	280	336	350	420	490	504
44	29	44	59	73	88	103	44	66	88	110	132	154	59	88	117	147	176	132	176	220	264	235	293	352	367	440	513	528
46	31	46	61	77	92	107	46	69	92	115	138	161	61	92	123	153	184	138	184	230	276	245	307	368	383	460	537	552
48	32	48	64	80	96	112	48	72	96	120	144	168	64	96	128	160	192	144	192	240	288	256	320	384	400	480	560	576
50	33	50	67	83	100	117	50	75	100	125	150	175	67	100	133	167	200	150	200	250	300	267	333	400	417	500	583	600

NAILS REQUIRED FOR DIFFERENT KINDS OF WORK.

FILE 694.231

For 1,000 shingles, 3½ to 5 lbs. 4*d.* nails, or 3 to 3½ lbs. 3*d.*

For 1,000 laths, about 7 lbs. 3*d.* fine.

For 1,000 feet clapboards, about 18 lbs. 6*d.* box.

For 1,000 feet covering boards, about 20 lbs. 8*d.* common, or 25 lbs. 10*d.*

For 1,000 feet upper floors, square edged, about 38 lbs. 10*d.* floor, or 41 lbs. 12*d.* floor.

For 1,000 feet upper floors, matched and blind-nailed, 38 lbs. 10*d.* or 42 lbs. 12*d.* common.

For 10 feet partitions, studs or studding, 1 lb. 10*d.* common.

For 1,000 feet furring, 1x3, about 45 lbs. 10*d.* common.

For 1,000 feet furring, 1x2, about 65 lbs 10*d.* common

For 1,000 feet pine finish, about 30 lbs. 8*d.* finish.

OVERLAYING CONSTRUCTION SHEET, SHINGLE AND COMPOSITION COVERING.

FILE 695.1

The average width of a shingle is four inches. Hence, when shingles are laid four inches to the weather each shingle averages 16 square inches, and 900 are required for a square of roofing (100 square feet). If 4½ inches to the weather, 800; 5 inches, 720; 5½ inches, 655; 6 inches, 600.

Slating.

FILE 695.2

Slating is estimated by the "square," which is the quantity required to cover 100 square feet. The slates are usually laid so that the third laps the first three inches.

Number of Slates per Square.

Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.
6 × 12	533	8 × 16	277	12 × 20	141
7 × 12	457	9 × 16	246	14 × 20	121
8 × 12	400	10 × 16	221	11 × 20	137
9 × 12	355	9 × 18	213	12 × 22	126
7 × 14	374	10 × 18	192	14 × 22	108
8 × 14	327	12 × 18	160	12 × 24	114
9 × 14	291	10 × 20	169	14 × 24	98
10 × 14	261	11 × 20	154	16 × 24	86

The weight of slate per cubic foot is about 174 pounds, or per square foot of various thicknesses as follows:

Thickness in inches.....	1/8	3/16	1/4	3/8	1/2
Weight in pounds.....	1.81	2.71	3 62	5.43	7.25

The weight per square foot of roof tiling, set in iron or between wood rafters ready for slating, is about 12 pounds.

Tin Roofs.

FILE 695.4

Tin roofs should be laid with cleats.

There are two kinds of tin—"bright tin," the coating of which is all tin, that is, the tin proper; and "tern," "leaded," or "roofing" tin, the coating of which is a composition, part tin and part lead. This last will not rust any quicker, but the sulphur in soft coal smoke eats through the "leaded" coating sooner than through the "tinned."

Sizes of tin, 10 by 14 and 14 by 20, and two grades of thickness—IC light, and IX, heavy. For a steep roof (one-sixth pitch or over) the IC 14 by 20 tin ("leaded" if high up where little smoke will get to it; "bright" if low down), put on with a standing groove, and with the cross seams put together with a double lock, makes as good a roof as can be made. For flat roofs IX 10 x 14 "light" is best, laid with cleats, but the others make good roofs and any of them will last twenty-five years at least, if painted periodically.

Number of Square Feet a Box of Roofing Tin Will Cover.—For flat seam roofing, using ½-inch locks, a box of "14 by 20" size will cover about 192 square feet, and for standing seam, using ⅜-inch locks and turning 1¼ and 1½ inch edges, making 1-inch standing seams, it will lay about 168 square feet.

For flat seam roofing, using ½-inch locks, a box of "28 by 20" size will cover about 399 square feet, and for standing seam, using ⅜-inch locks and turning 1¼ and 1½ inch edges, making 1-inch standing seams, it will lay about 365 square feet.

Every box of roofing plates (IC or IX "14 by 20" or "28 by 20" sizes) contains 112 sheets.

For roofs and gutters use seven-pound lead; for hips and ridges, six-pound; for flashings, four-pound.

Gutters should have a fall of at least one inch in ten feet.

No sheet lead should be laid in greater length than ten or twelve feet without a dip to allow for expansion.

Joints to lead pipes require a pound of solder for every inch in diameter.

GRAVEL ROOFING SPECIFICATIONS.

Adopted by the Chicago Master Composition Roofers' Association.

First lay five (5) thicknesses of No. 2 wool roofing felt, weighing not less than fourteen (14) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together, mopping not less than (20) inches between each layer, with best roofing cement, using not less than one-hundred and twenty-(120) pounds of roofing cement to the square of one hundred feet. All joinings along the walls and around the openings to be carefully made. Then cover the entire surface with a coating of roofing cement and screened gravel, using not less than one-sixth (1-6) of a cubic yard of gravel to the square of one-hundred (100) feet. The gravel to be what will pass through not larger than a ⅝ inch mesh screen and to be free from sand and loam.

This roof shall be guaranteed for a period of five (5) years.

N. B.—Over open board construction and all buildings not plastered, use one (1) thickness of rosin sized sheathing paper.

Following are three old standard specifications used in the west for many years.

Five (5) Ply Wool Felt, Composition and Gravel Roof.

First cover the sheathing boards with one (1) layer of dry felt and over this put four (4) thicknesses of wool roofing felt, weighing not less than fifteen (15) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together the full width of the lap, not less than nine (9) inches between each layer, with best roofing cement, using not less than one hundred (100) pounds of roofing cement to the square of one hundred (100) feet. All joinings along walls and around openings to be carefully made. The roof to be then covered with a heavy coating of roofing cement and screened gravel, not less than one (1) cubic yard of gravel to six hundred (600) square feet, gravel to be screened through ⅝-inch mesh and free from sand and loam. All walls and openings to be flashed. If not, the rear end of the walls to be flashed not less than fifteen (15) feet from the gutter on each side.

Six (6) Ply Cap Sheet Wool Felt, Composition and Gravel Roof.

First cover the sheathing boards with one (1) layer of dry felt and over this put four (4) thicknesses of wool roofing felt, weighing not less than fifteen (15) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together the full width of the lap, not less than nine (9) inches between each layer, with best roofing cement, using not less than one hundred and twenty (120) pounds of roofing cement to the square of one hundred (100) feet. The entire surface then to be mopped over with roofing cement and a cap sheet of wool felt applied. All joinings along the walls and around the openings to be carefully made. The roof to be then covered with a heavy coating of roofing cement and screened gravel, not less than one (1) cubic yard of gravel to six hundred (600) square feet, gravel to be screened through ⅝-inch mesh and free from sand and loam. All walls and openings to be flashed. If not, the rear end of the walls to be flashed not less than fifteen (15) feet from the gutter on each side.

Six (6) Combined Flax and Wool Felt, Composition and Gravel Roof.

First cover the sheathing boards with one (1) layer of dry felt and over this put one (1) layer of flax felt and three thicknesses of wool roofing felt, weighing not less than fifteen (15) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together the full width of the lap, not less than eleven (11) inches between each layer, with best roofing cement, using not less than one hundred and twenty (120) pounds of roofing cement to the square of one hundred (100) feet. The entire surface then to be mopped over with roofing cement and a cap sheet of wool felt applied. All joinings along walls and around openings to be carefully made. The roof to be then covered with a heavy coating of roofing cement and screened gravel, not less than one (1) cubic yard of gravel to six hundred (600) square feet, gravel to be screened through ⅝-inch mesh and free from sand and loam. All walls and openings to be flashed. If not, the rear end of the walls to be flashed not less than fifteen (15) feet from the gutter on each side.

Capacity of Cisterns.

FILE 696

For a circular cistern, square the diameter and multiply by .7854, for the area; multiply this by 1,728 and divide by 231, for number of gallons of one foot in depth; for a square cistern, multiply length by breadth, and proceed as above.

CIRCULAR CISTERN.

5 feet in diameter holds 4.66 bbls.
6 feet in diameter holds 6.71 bbls.
7 feet in diameter holds 9.13 bbls.
8 feet in diameter holds 11.93 bbls.
9 feet in diameter holds 15.10 bbls.
10 feet in diameter holds 18.65 bbls.

SQUARE CISTERN.

5 feet by 5 feet holds 5.92 bbls.
6 feet by 6 feet holds 8.54 bbls.
7 feet by 7 feet holds 11.63 bbls.
8 feet by 8 feet holds 15.19 bbls.
9 feet by 9 feet holds 19.39 bbls.
10 feet by 10 feet holds 23.74 bbls.

Wrought-iron Welded Pipe.

DIMENSIONS, WEIGHTS, ETC., OF STANDARD SIZES FOR STEAM, GAS, WATER, OIL, ETC.

Inside Diameter	Outside Diameter	External Circumference, A	Length of Pipe per Sq Foot of Outside Surface.	Internal Area	External Area.	Length of Pipe containing one Cubic Foot.	Weight per Foot of Length	No. of Threads per Inch of Screw.	Contents in *Gallons per Foot.	Weight of Water per Foot of Length.
In.	In	In.	Ft.	In.	In	Ft	Lbs.			Lbs.
⅛	40	1 272	9.44	012	129	2,500	.24	27	.0006	005
¼	.54	1.636	7.075	049	229	1,385.	42	18	.0026	021
⅜	67	2.121	5.657	110	358	751.5	.56	14	0057	.047
½	84	2 652	4.502	196	554	472.4	84	14	0102	085
¾	1 05	3 299	3 637	441	866	270.	1.12	11½	0230	190
1	1 31	4 134	2 903	785	1.357	166.9	1 67	11½	0408	.349
1¼	1 66	5.215	2 301	1 227	2 164	96.25	2.25	11½	0638	527
1½	1 9	5.969	2.01	1.767	2 835	70.65	2.69	11½	0918	760
2	2 37	7.461	1 611	3.141	4.330	42.36	3.66	8	1632	1.356
2½	2 87	9 032	1 328	4.908	6.491	30 11	5.77	8	2550	2.116
3	3 5	10 996	1 091	7.068	9.621	19 49	7.54	8	3673	3 049
3½	4	12.566	955	9 621	12 566	14.56	9 05	8	.4998	4 155
4	4 5	14 137	849	12.566	15.904	11.31	10.72	8	6528	5.405
4½	5.	15 708	765	15.904	19 635	9 03	12.49	8	8263	6.851
5	5.56	17 475	629	19 635	24.299	7 20	14.56	8	1.020	8.500
6	6 62	20 813	577	28 274	34.471	4 98	18 76	8	1 469	12.312
7	7.62	23 954	505	38 484	45.663	3.72	23 41	8	1.999	16.662
8	8 62	27.096	.441	50.265	58 426	2.88	28 34	8	2 611	21.750
9	9 68	30 433	394	63 617	73 715	2 26	34 67	8	3.300	27 500
10	10 75	33 772	355	78.540	90.792	1 80	40 64	8	4 081	34 000

* The Standard U. S. gallon of 231 inches.

Divide the external circumference column, A, by 12 and the result will be the square feet of surface per lineal foot

Grade Per Mile.

The following table will show the grade per mile:

An inclination of

1 foot in 15 is 352 feet per mile.
1 foot in 20 is 264 feet per mile.
1 foot in 25 is 211 feet per mile.
1 foot in 30 is 176 feet per mile.
1 foot in 35 is 151 feet per mile.
1 foot in 40 is 132 feet per mile.
1 foot in 50 is 106 feet per mile.
1 foot in 100 is 53 feet per mile.
1 foot in 125 is 42 feet per mile.

To find quantity of water elevated in one minute running at 100 feet of piston speed per minute: Square the diameter of the water cylinder in inches and multiply by 4. Example: Capacity of a 5-inch cylinder is desired. The square of the diameter (5 inches) in 25, which, multiplied by 4, gives 100, the number of gallons per minute (approximately).

Quantity of Brickwork in Barrel Drains and Wells.

Diameter in Clear	Thickness of Brickwork	Superficial Feet of Brickwork in One Linear Yard.	Number of Bricks Required for One Linear Yard
1 foot, 0 inches	0 feet, 4½ inches	16 feet, 6 inches	115
1 " 6 "	0 " 4½ "	21 " 2 "	148
2 " 0 "	0 " 4½ "	25 " 10 "	181
2 " 0 "	0 " 9 "	33 " 0 "	462
2 " 6 "	0 " 9 "	37 " 8 "	528
2 " 6 "	1 " 1 "	43 " 2 "	906
3 " 0 "	0 " 9 "	42 " 6 "	594
3 " 0 "	1 " 1 "	47 " 10 "	1004
3 " 6 "	0 " 9 "	47 " 1 "	659
3 " 6 "	1 " 1 "	52 " 7 "	1104
4 " 0 "	0 " 9 "	51 " 10 "	725
4 " 0 "	1 " 1 "	57 " 3 "	1203
5 " 0 "	0 " 9 "	61 " 3 "	857
5 " 0 "	1 " 1 "	66 " 9 "	1402
6 " 0 "	1 " 1 "	76 " 1 "	1597
7 " 0 "	1 " 1 "	85 " 6 "	1795

Tests for Pure Water.

Color: Fill a clean long bottle of colorless glass with the water; look through it at some black object. It should look colorless and free from suspended matter. A muddy or turbid appearance indicates soluble organic matter or solid matter in suspension. Odor: Fill the bottle half full, cork it, and leave it in a warm place for a few hours. If when uncorked it has a smell the least repulsive, it should be rejected for domestic use. Taste: If water at any time, even after heating, has a disagreeable taste, it should be rejected.

A simple semi-chemical test is known as the "Heisch test." Fill a clean pint bottle three-fourths full of the water; add a half-teaspoonful of clean granulated or crushed loaf sugar; stop the bottle with glass or a clean cork and let it stand in a light and moderately warm room for forty-eight hours. If the water becomes cloudy, or milky, it is unfit for domestic use.

Capacity of Drain Pipe.

Size of Pipe.	Gallons per Minute.							
	½-in. Fall per 100 ft.	3-in. Fall per 100 ft.	6-in. Fall per 100 ft	9-in. Fall per 100 ft.	12-in Fall per 100 ft.	18-in. Fall per 100 ft.	24-in Fall per 100 ft.	36-in. Fall per 100 ft.
3-inch	21	30	42	52	60	74	85	104
4 "	36	52	76	92	108	132	148	184
6 "	84	120	169	206	240	294	338	414
9 "	232	330	470	570	660	810	930	1140
12 "	470	680	960	1160	1360	1670	1920	2350
15 "	830	1180	1680	2040	2370	2920	3340	4100
18 "	1300	1850	2630	3200	3740	4600	5270	6470
20 "	1760	2450	3450	4180	4860	5980	6850	8410

Table showing the velocity of discharge of different sized sewers.

Diam. of pipe.	180 feet per minute, 3 feet per second.		270 feet per minute, 4½ feet per second.		360 feet per minute, 6 feet per second.		540 feet per minute, 9 feet per second.	
Inches.	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute.
3.....	1 in 69	54	1 in 30.4	81	1 in 17.2	108	1 in 7.6	162
4.....	1 in 92	96	1 in 40.8	144	1 in 23.	192	1 in 10.2	288
6.....	1 in 138	216	1 in 61.2	324	1 in 34.5	432	1 in 15.3	648
9.....	1 in 207	495	1 in 92.	742.5	1 in 51.7	990	1 in 23	1,485

STANDARD SIZE OF CONDUITS FOR THE INSTALLATION OF WIRES AND CABLES.

As adopted and recommended by The National Electrical Contractors' Association of the United States.

Conduit sizes based on the use of not more than three 90 degree elbows in runs taking up to and including No. 10 wires; and two elbows for wires larger than No. 10. Wire No. 8 and larger are stranded.

NUMBER OF WIRES IN SYSTEM.

Size B. & S.	Cap'y Amps.	One wire in a conduit. Size conduit, in. Inter'l.	Exter'l.	Two wires in a conduit. Size conduit, in. Inter'l.	Exter'l.	Three wires in a conduit. Size conduit, in. Inter'l.	Exter'l.	Four wires in a conduit. Size conduit, in. Inter'l.	Exter'l.
14	12	½	.84	½	.84	½	.84	¾	1.05
12	17	½	.84	¾	1.05	¾	1.05	¾	1.05
10	24	½	.84	¾	1.05	¾	1.05	1	1.31
8	33	½	.84	1	1.31	1	1.31	1	1.31
6	46	½	.84	1	1.31	1¼	1.66	1¼	1.66
5	54	¾	1.05	1¼	1.66	1¼	1.66	1¼	1.66
4	65	¾	1.05	1¼	1.66	1¼	1.66	1½	1.9
3	76	¾	1.05	1¼	1.66	1¼	1.66	1½	1.9
2	90	¾	1.05	1¼	1.66	1½	1.9	1½	1.9
1	107	¾	1.05	1½	1.9	1½	1.9	2	2.37
0	127	1	1.31	1½	1.9	2	2.37	2	2.37
00	150	1	1.31	2	2.37	2	2.37	2½	2.87
000	177	1	1.31	2	2.37	2	2.37	2½	2.87
0000	210	1¼	1.66	2	2.37	2½	2.87	2½	2.87
CM.									
250000	235	1¼	1.66	2½	2.87	2½	2.87	3	3.5
300000	270	1¼	1.66	2½	2.87	2½	2.87	3	3.5
400000	330	1¼	1.66	3	3.5	3	3.5	3½	4.
500000	390	1½	1.9	3	3.5	3	3.5	3½	4.
600000	450	1½	1.9	3	3.5	3½	4.		
700000	500	2	2.37	3½	4.	3½	4.		
800000	550	2	2.37	3½	4.	4	4.5		
900000	600	2	2.37	3½	4.	4	4.5		
1000000	650	2	2.37	4	4.5	4	4.5		
1250000	750	2½	2.87	4½	4.5	4½	5.		
1500000	850	2½	2.87	4½	5.	5	5.56		
1750000	950	3	3.5	5	5.56	5	5.56		
2000000	1050	3	3.5	5	5.56	6	6.62		

DUPLEX WIRE.

14	12	½	.84	¾	1.05	1	1.31	1	1.31
12	17	½	.84	¾	1.05	1	1.31	1¼	1.66
10	24	¾	1.05	1	1.31	1¼	1.66	1¼	1.66

Example—To ascertain the size of conduit for three No. 4-o wire, follow down the wire column to No. 4-o and then across to the section headed "Three wires in a conduit" and it will be seen that 2½ inch conduit is the size to use and that the external diameter is 2.87 inches.

Hot-Water and Steam Heating—Overhead System.

FILE 697.41

In using steam for the heating of high buildings, it is necessary to use the overhead plan, unless some automatic system of expelling the air is adopted. It requires less power to force the air through the standpipe than it would through a large number of risers. The air is forced out on the descent of the steam, and less fuel and power are necessary.

The overhead hot-water system is coming into general use, as it can be put in so that the farthest radiators in a building will heat at the same time as those nearer the boiler, and the result will also be felt in rooms in the basement—the principle of the siphon causing the effect.

The pipes from the main in the attic, from which the several branches are taken, can be pitched so that heat in the several parts of a building will result as quickly as desired; either an open or closed tank can be used. The pipes exposed in attic should be covered. Opinions vary as to the sizes of pipe to be used.

List of Sizes of Steam Mains.

FILE 697.42

To determine the size of pipes no fixed rule can be given which will apply in all cases. A rule that has generally been accepted by steam fitters as good practice, is to allow the area of a one-inch pipe (.7854 square inches) for every 100 square feet of radiating surface, including mains.

BOILER EFFICIENCY TABLE

Based on evaporation from and at 212° F.

B. T. U. Per Lb. Coal.	50% Efficiency		55% Efficiency		60% Efficiency		65% Efficiency		70% Efficiency		75% Efficiency		80% Efficiency	
	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.	Evaporation Per Lb. Coal.	Lbs. Coal Per H. P. Hour.
7500	3.8	9.0	4.2	8.2	4.6	7.5	5.0	6.8	5.4	6.4	5.8	6.0	6.2	5.5
8000	4.1	8.4	4.5	7.6	4.9	7.0	5.3	6.5	5 7	6.0	6.2	5.5	6.6	5.2
8500	4.4	7.8	4.8	7.1	5.2	6.6	5.7	6.0	6.1	5.6	6 6	5.2	7.0	4.9
9000	4.6	7.5	5.1	6.7	5.5	6.2	6.1	5.5	6.5	5.3	6.9	5.0	7.4	4.6
9500	4.9	7.0	5.4	6.3	5.9	5.8	6.3	5.4	6.8	5.0	7.3	4.7	7.8	4.4
10000	5.1	6.7	5.6	6.1	6.2	5.5	6.7	5.1	7.2	4.7	7.7	4.4	8.2	4.2
10500	5.4	6.3	5.9	5.8	6.5	5.3	7.1	4.8	7.6	4.5	8.1	4.2	8.6	4.0
11000	5.6	6.1	6.2	5.5	6.8	5.0	7.4	4.6	7.9	4.3	8.5	4.0	9.1	3.7
11500	5.9	5.8	6.5	5.3	7.1	4.8	7.7	4.4	8.3	4.1	8.9	3.8	9.5	3.6
12000	6.2	5.5	6.8	5.0	7.4	4.6	8.0	4.3	8.6	4.0	9.3	3.7	9.9	3.4
12500	6.4	5.3	7.1	4.8	7.7	4.4	8.4	4.1	9.0	3.8	9.7	3.5	10.3	3.3
13000	6.7	5.1	7.4	4.6	8.0	4.3	8.7	3.9	9.4	3.6	10.0	3.4	10.7	3.2
13500	6.9	5.0	7.6	4.5	8.3	4.1	9.0	3.8	9.7	3.5	10.4	3.3	11.1	3.1
14000	7.2	4.7	7.9	4.3	8.6	4.0	9.4	3.6	10.1	3.4	10.8	3.2	11.5	3.0
14500	7.5	4.6	8.2	4.2	9.0	3.8	9.7	3.5	10.5	3.2	11.2	3.0	12.0	2.8

SPACE OCCUPIED BY FUEL.

Coals of the same size coming from different mines vary in density, but the space given below is an average for best fuels:

Stove Anthracite	33	cubic feet per 2,000 lbs.
Egg Anthracite	32.5	cubic feet per 2,000 lbs.
Soft Coal	40	cubic feet per 2,000 lbs.
Coke	68	cubic feet per 2,000 lbs.

Transmission of Heat by Various Substances.

FILE 697.0

Window glass being	1,000
Oak or Walnut	66
White Pine	80
Pitch Pine	100
Lath and Plaster	75 to 100
Brick (rough)	200 to 250
Brick Whitewashed	200
Granite or Slate	250
Sheet Iron	1,030 to 1,110

Table Showing Amount of Glass Surface which may be Heated by 1 Square Foot of Radiating Surface in Good Buildings.

	Hot Water.			Steam.	
Temperature of radiating surface (radiators) Fahr	160°	180°	200°	227° 5 Lbs.	240° 10 Lbs.
	Square Feet of Glass to 1 Square Foot Radiator Surface.				
Temperature above surrounding air 90°	1.9	2.3	2.8	3.3	3.8
" " " " 80°	2.3	2.9	3.5	4.0	4.6
" " " " 70°	3.0	3.6	4.2	5.0	5.7
" " " " 60°	4.0	4.6	5.25	6.0	7.0
" " " " 50°	5.0	6.0	6.8	8.0	9.0
" " " " 40°	6.9	8.0	8.2	10.0	11.5

Formulae for Figuring Radiation for Factories.

A formula for figuring radiation which is used by some of the best heating engineers in determining the amount of radiation for factory buildings is as follows: $\frac{G}{3.3} + \frac{W}{10.9} + \frac{V}{171} =$ sq. ft. of radiation in which, G = Glass Area.
W = Net Wall Area.
V = Volumn of air in the Room.

SIZE OF STANDARD FLUE LINING ON SALE ON THIS MARKET.

Outside size.	Inside size.	Inside area.
4¼ x 8½ in.	3⅛ x 7¼ in.	22.6 sq. in.
8½ x 8½ in.	7 x 7 in.	49 sq. in.
13 x 13 in.	11⅝ x 11⅝ in.	135 sq. in.
4½ x 13 in.	3⅛ x 11⅝ in.	36.5 sq. in.
8½ x 13 in.	6⅝ x 11⅝ in.	77 sq. in.
13 x 18 in.	11½ x 16¾ in.	193 sq. in.
8½ x 18 in.	6⅞ x 16½ in.	114 sq. ln.
18 x 18 in.	15¾ x 15¾ in.	247 sq. in.

GENERAL RULE FOR BRICK STACKS.

Diameter of base should not be less than 1/10 of height if square, or round, 1/12 of height. Batter of stacks 3/100 of an inch to the foot in height. Thickness of brick fork should be not less than one brick from top to 25 feet below same, changing to 1½ brick from 25 feet to 50 feet below top, increasing ½ brick in thickness for each succeeding 25 feet, measuring from the top downward.

Fireplace Flue Areas.

For three-story building, area at top of smoke chamber should be 1/12 of area of fireplace opening.

Two-story building area at top of smoke chamber should be 1/10 of area of fireplace opening.

One-story building area at top of smoke chamber should be ⅛ area of fireplace opening.

Throat of fireplace should never be less than 3 in. or more than 4½ in. by the width of fireplace opening.

Front edge of arch should never be thicker than one-half brick, approximately 4 in.

Splay of sides of flue from throat opening up to flue lining should be 2 in. to the foot. The raise from soffit or lintel, or from highest point or soffit to arch should be 6 in.

Proportion of Parts of Steam Heating Boilers.

FILE 697.43

FROM PROF. R. C. CARPENTER.

Radiating surface=square feet	250	500	750	1000	1500	2000	3000	4000	5000	7500	10000
Nominal horse-power	2.5	5.0	7.5	10.0	15.0	20.0	30.0	40.0	50.0	75.0	100.0
Ratio radiating to heating surface	4.5	5.1	5.4	5.6	6.0	6.2	6.7	6.9	7.0 / 9.0*	7.0 / 9.0*	7.0 / 9.0*
Probable evaporation per lb. coal	5.5	5.7	6.0	6.5	7.0	7.5	8.0	8 5	9.0	9.5	10.0
Pounds of steam per sq. ft. grate (A)	55.0	57.0	60.0	65.0	70.0	75.0	80.0	85.0	90.0	95.0	100.0
Pounds of steam per sq. ft. grate (B)	44.0	46.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
Ratio radiating to grate surface (A)	165.0	171.0	180.0	195.0	210.0	225 0	240.0	255.0	270.0	285.0	300.0
Ratio radiating to grate surface (B)	132.0	138.0	144.0	156.0	168.0	180.0	192.0	204 0	216.0	228.0	240.0
Ratio heating to grate surface (A)	36.5	33.2	33.2	34.8	35.0	36 2	36.5	37.0	38.5	40.5 / 31.5*	42.5 / 33.3*
Ratio heating to grate surface (B)	28.5	27.0	26.7	27.7	28.0	29.0	29.3	29.6	30.8	32.2 / 25.2*	34.5 / 26.5*
Heating surface, square feet	55.0	98.0	138.0	178.0	250.0	322.0	447.0	580.0	710.0	1071 / 833*	1430 / 1111*
Grate surface, square feet (A)	1.52	2.92	4.15	5.68	7.15	8.9	12.4	15.7	18.5	26.5	33.3
Grate surface, square feet (B)	1.88	3.88	5.4	6.37	8.92	11.2	15.5	19.5	23.2	32.5	41.5
Diameter of safety valve, inches	1.5	2.25	2.50	2.75	3.0	3.25	3.5	4.2	4.0	2 of 3	2 of 4
Diameter of smoke flues, inches	7.0	10.0	11.2	12.0	15.0	17.0	19.0	23.0	25.0	28	3A
Square inches in above flues	38.5	78.5	95.0	113.0	176.7	227.0	283.5	415.5	490.9	615.7	907.9

* Water tube boilers.

A When rate of coal consumption is 10 pounds per hour each square foot grate surface.

B When rate of coal consumption is 8 pounds per hour each square foot grate surface.

PROTECTIVE, PRESERVATIVE AND DECORATIVE COVERINGS.

STANDARD PAINTERS' MATERIALS.

An attempt is made in the following to define those materials which may be readily prepared by any competent painter, that are generally accepted as standard for high grade work. Such materials very properly form the basis of comparison for all proprietary paints. No proprietary preparation should be accepted for use that does not equal in enduring wearing quality, appearance, cost and ground for subsequent coats, the materials hereinafter described.

Classification of preservative and decorative coverings is commonly made according to the nature of the surfaces which these materials are designed to cover.

Materials for painters' work are divided according to their nature under the following headings: Pigments, Binders and Agents or Solvents.

Paint consists of a binder or binders and a pigment or pigments incorporated or mixed together. Mixing of paint ingredients may be accomplished in a satisfactory manner, either by stirring or grinding together by hand or by machinery. Machinery mixing with proper apparatus is most certain to secure uniformity of result, and is therefore advised where practical.

Linseed Oil is the only known universally successful binder for paint and the holding power of the paint depends almost entirely on the strength of the linseed oil used. This oil is adulterated in many ways, but the most common is with mineral oil. The manufacturers of mineral oil substitute have perfected their product to such an extent that it is difficult to distinguish it from the real article except by chemical test or actual use, when its inferiority is quickly manifest.

STANDARD BINDERS.

Raw Linseed Oil is the oil obtained from the seeds of the flax-plant, linum usitatissimum, and what is known as commercially pure grade, has a specific gravity of not less than .931, nor in excess of .937, when the temperature is 15½ deg. centigrade. It is a straw yellow in color, weighs approximately 7½ lbs. to the gallon, has a boiling point at 260 deg. Fah. and solidifies at 17 deg. Fah.

Boiled Linseed Oil, commercially pure, consists of raw linseed oil as above defined, kettle boiled at a temperature not to exceed 500 deg. Fah. nor less than 300 deg. Fah.; or the same sort of oil prepared with best pure Japan dryers, so as to increase drying qualities. If salts of lead or manganese are thoroughly incorporated into the raw oil, very similar results are produced to the boiling process. An old method of increasing the drying properties of linseed oil was to heat the oil to near the temperature at which it undergoes destructive distillation (550 deg. Fah. or therabouts), and stir in at the same time, oxide of lead or oxide of manganese, or both. Such method, however, darkens the oil very much.

Spirits of Turpentine, chemically pure, is composed of a volatile oil obtained by the distillation of turpentine oil obtained by tapping or boxing yellow pine trees. It is a clear, colorless liquid, with a pleasant, pungent odor and shows a very slight residue when evaporated. Spread over any surface in a thin layer, it will dry in twenty-four hours, leaving hard dry varnish. Turpentine weighs about 7 lbs. to the gallon of bulk.

STANDARD PIGMENTS.

Red Lead, practically pure from a commercial standpoint, is equal to 98 per cent lead tetroxide; but to secure this degree of purity it is practically impossible to eliminate .1 to .5 per cent of soda or nitrate salts which are likely to be active in promoting rust, and, in consequence, should not be used in this form for the painting of metal.

Red Lead for Painting Metal, in order to secure the best results should comply with the following formula: Pb_3O_4 (tetroxide of lead), 82.88 per cent plus litharge PbO (monoxide of lead) 17.12 per cent. Owing to the tendency of this combination of red lead and litharge pigment to unite with linseed oil in chemical combination, paint composed of red lead and linseed oil should not be prepared to exceed twenty-four hours before using. For if this combination of red lead and litharge is mixed with linseed oil and sealed up in an air-tight can, it will be found after a time that the mixture has solidified showing that the oxygen of the air which is the hardening agent in ordinary paints is not necessary.

Colors are produced by mixing the various color pigments with the standard base pigments of lead or zinc. Some of those color pigments contribute slightly to the endurance of the paint but generally speaking most color pigments do not add to the protective and enduring value of paint. The volume of base pigment needs to be reduced in proportion to the amount of color pigment added, so as to maintain the same relative relation of pigment to oil in the various coats as hereinafter prescribed. The scope of this article does not permit a discussion of the composition and merits of the numerous commercial color-pigments offered to the trade.

Carbonate of Lead = chemically to $PbO\ CO_2$, was the lead formerly used in paints as a pigment. The fumes of this preparation of lead are poisonous and workmen have to be very careful in handling this material to avoid soiling hands or inhaling fumes from the same.

Sublimed Lead or Basic Lead Sulphate = chemically to $PbSO_4$, is coming into general use for paints and is practically non-poisonous and just as valuable as a pigment.

White Lead Paste averages to contain by bulk 92% dry lead pigment and 8% linseed oil and weighs about 38.1206 lbs. to the gallon of bulk.

Zinc White is oxide of zinc made by burning zinc in air. It is whiter than white lead but is not so opaque, and more coats of zinc paint are necessary to get a given effect over a dark background than of white lead. Paint consisting of commercially pure zinc white and linseed oil makes a strong and enduring wearing surface but does not produce as satisfactory ground for repainting after a period of service, as paint composed of a white lead pigment and linseed oil.

Chemical action between the pigments and oil in paint ordinarily does not occur, but there are exceptions. Sabin states that such action takes place with White Lead and Linseed Oil, "probably between the oil and the lead hydrate, which constitutes at least a quarter of the pigment." "This change is said to be due to resinification of the oil converting into a sort of varnish." "Zinc Oxide (White Zinc) also acts on oil, but in a much less degree." "Paint consisting of White Lead and White Zinc mixed together in the proportions of two of lead to one of zinc is reputed to be superior to either alone.

Zinc brushes more readily, but will cover less surface than White Lead."

PAINT.

Primer of Lead and Oil for new work should be proportioned by bulk, so as to contain 27% of White Lead Paste, 62% of Linseed Oil and 11% of Turpentine.

Priming Lead and Oil will require 10.3 lbs. White Lead, .62 gal. Linseed Oil and .11 gal. Turpentine to make one gal. of paint.

One Gallon Lead and Oil Primer will average to properly cover about 2¾ squares of new wood work or 1¼ squares of common brick work.

One Square of New Wood Work requires to properly prime same with lead and oil 3¾ lbs. White Lead. .23 gal. Linseed Oil and .04 gal. Turpentine, or if common brick requires 8.24 lbs. White Lead, .5 gal. Linseed Oil and .088 gal. Turpentine.

Succeeding Coats of Lead and Oil Paint after primer should be proportioned by bulk so as to contain 30% White Lead, 64% Linseed Oil and 6% of Turpentine.

Succeeding Coats of Lead and Oil Paint after priming will require 11.44 lbs. White Lead Paste, .64 gal. Linseed Oil and .06 gal. of Turpentine to the gal.

One Gallon Lead and Oil Succeeding Coater will average to properly cover, any coat, about 4½ squares of wood work after same has been primed, or 3 squares of common brick work, second coat. Third coat on brick work, one gal. will cover as much surface as on wood.

One Square of Any Oil Succeeding Coat on wood work after same has been primed will average to require to properly cover same 2.54 lbs. White Lead, .14 gal Linseed Oil and .0133 gal. of Turpentine; or for 2nd coat on common brick work, 3.48 lbs. White Lead, .21 gal. Linseed Oil and .02 gal. of Turpentine. (Third coat on brick work will require the same amount of paint to unit of surface as "Succeeding Coats" on wood.

Paint for metal, first coat, should not be applied until after the surface is thoroughly cleaned free from dirt or grease, as such material keeps the coating from coming in contact with the metal, so that it cannot adhere to same. It might be supposed that grease would be absorbed by paint or varnish but this does not prove true in practice. To mix such materials would require their thorough agitation together. This is prevented in the application over dirty surfaces due to the fact that the grease is always mixed with and covered by an adherent film of dirt, which interferes with the action of the paint or varnish upon it: consequently making a loose film which will not permanently support the paint coating.

Primer for metal of red lead to give satisfactory results can be made by mixing 23 lbs. of dry "red lead for painting metal" to 1 lb. of "zinc white," adding sufficient commercially pure "raw linseed oil" to make a gallon of the mixture, and thoroughly incorporating together. The mixing of the oil and pigment should only be as required at the work, never to exceed 24 hours before applying. The paint resulting will be rather stiff and requires thorough and careful brush work to make the surface elastic, and the material cover proper area. This paint should not be thinned by addition of evaporent liquids, as these have a tendency to produce destructive chemical action on the paint, effecting its permanency as a protective coating.

Succeeding coats on metal, after primer, can very satisfactorily be of white lead and oil or zinc paints as above described, or a combination of the two.

Primer for masonry surface which has a strong alkaline reaction, such as plastered walls, brick masonry and concrete, should consist of a solution of zinc sulphate crystals dissolved in water, in the proportion of 3 lbs. to the gallon, after which succeeding coats of paint as defined above for wood work may be applied with satisfactory results. Oil paint should never be applied direct to masonry. There are a number of proprietary mixtures that are prepared especially for this purpose and which give excellent results.

Paste Filler for open grained hard-wood finish or floors requires for proper filling and wiping 1⅔ lbs. Silex paste and .14 gal. thinner to the square.

Wiping of paste filler is done with burlap, sea moss or excelsior and should always be done across the grain of the wood as if rubbed with the grain of the wood there is a tendency to lift the filler out of the pores of the wood and waste same, requiring more filler to give satisfactory results.

Thinner for paste filler may be either Turpentine or Benzine if the filler is of best quality of rock quartz, water floated, very finely bolted and mixed with special Japans and Linseed Oil, Benzine seems to give the most satisfactory results for a thinner owing to its quicker evaporation. For the cheaper fillers Turpentine must be used.

Paste Filler is tinted or left transparent according to the color effect desired.

Stains for wood work usually form one coat in addition to filler and coats of varnish or wax; these are of three kinds, oil-stain, spirit-stain and water-stain, and are used according to the effect desired.

Oil-Stain averages to require about .16 gal. to the square.

Spirit-Stain averages to require about .16 gal. to the square.

Water-Stain averages to require about .2 gal. to the square.

Prepared Wax averages to require about .33 lbs. to the square.

Varnish, Best Light Interior, requires for properly coating one square, 1st coat over filler, 1-5 to 1-7 gal.

Varnish, Cheap, Thick Rosin, requires for coating one square one gloss coat, ¼ to 1-5 gal.

Creosote Stain required to dip ⅔ length one M. shingles equals about 2¾ gal.

Creosote Stain required to brush coat one square shingles equals one gal.

Oil Paint to cover one square metal work, one coat requires about 1-10 gal.

ESTIMATES ON PAINTING.

PAINTER'S ESTIMATE=(units of surface to be covered) × (amount of material required to cover a unit) × (cost of a unit of material) + [(number of hours of labor required by a mechanic to apply the material to a single unit of surface) × (hourly wage of mechanic) × (number of units of surface)] + (overhead charges, including scaffolding, brushes, drop-cloths, cartage, office expense and expense of supervision, etc.) + **(Contractor'sprofit,** which varies with the supply and demand).

UNITS OF SURFACE USED ARE (one sq. ft.), (sq. yd. = 9 sq. ft.) or **(square** = 100 sq. ft.).

AMOUNT OF SURFACE UNITS assumed for estimating purposes are increased at the judgment of the estimator. This is done to make proper allowance for increased labor and waste of material on account of broken and complicated surfaces, and so that prices per unit of labor and material can be maintained constant, the following enumerations being the assumptions most commonly used by estimators:

PLAIN D. & M. Wainscoting or partition stuff is measured once, actual surface, and is used as the standard of comparison. Other surfaces are increased in proportion as their difficulty of execution compares with D. & M. Wainscoting.

Sash for exterior are measured over the entire area instead of around each bar.

Shingle Gable, 1½ × actual surface area.

Dormer Windows 2 × actual surface area.

Shingles, Rough, 1½ to 2 × actual surface area.

Shingles, Dressed, Dimension, actual surface measure.

Spindle work, measure 4 times solid on one side.

Square Spindle work and pickets, 4 × one side measured solid.

Verandas with heavy columns and railings, etc., measure surface of ceiling and floors and all sides the same as though enclosed veranda. Very simple in design, measure floor and ceiling and allow double area of brackets and columns.

Outside Blinds, measure 3 × actual surface of one side.

INTERIOR.

Base Boards, measure not less than 1 foot in width regardless of actual width.

Picture Mouldings, measure 1-3 foot in width.

Single Doors, including trim, count as 25 sq. ft. to a side or 70 sq. ft. for both sides

Interior Side of Windows, including trim and tracing of sash, average at 35 sq. ft.

Wall Decorations, measure ceiling solid and sidewalls 8-10 of actual area to allow for openings, or measure actual area and deduct ½ to ⅔ of all openings.

Badly Weathered wood work or cracked and damaged plaster, add from 1-10 to 3-10 to measurements determined as above.

Prices of standard materials are quoted in market reports and fluctuate with supply and demand. The estimator should verify these preceding each estimate. At time of going to press the following prices obtain:

White Lead Paste, 6¾c per lb.

Linseed Oil, raw, 48c per gal.

Turpentine, boiled, 49c per gal.

Paste Filler, about 10c per lb. in 100-lb. packages or 8½c in bbls.

Interior Varnishes, about $1.87 to $2.00 per gal.

Stains vary so much in price that they can not be listed.

First Class Exterior Varnishes, about $3.50 per gal. (It should be explained that owing to the slow drying or hardening qualities of best exterior varnishes, a cheaper and less durable grade is usually used, costing about $2.50 per gal.)

Proprietary Oil Paints of best quality are sold to the painters at about $1.55 to $1.60 per gal., depending on color. The materials in a gal. of White Lead and Linseed Oil "Succeeding Coat" of paint costs exclusive of labor and coloring matter about $1.20 at present market prices and the labor of mixing by hand and the expense for colors brings this hand-mixed paint up in price to about the same as proprietary paints of equal quality. Unless the ingredients composing paint are thoroughly incorporated the paint is not satisfactory. This proper mixing, if done by hand, requires considerable expensive labor.

LABOR REQUIRED.

COST OF LABOR = (number of hours of labor required by a mechanic to apply the material to the single unit of surface) × (hourly wage of mechanics) × (number of units of surface).

Wage per Hour = union scale obtaining in the locality where the work is to be executed. (In Chicago, this is 65 per hour under an agreement expiring April 1st, 1914.)

Stopping knots with shellac requires in labor .2 of an hour's time to the square of surface.

Puttying defects in ordinary wood work requires in labor .3 of an hour's time to the square of surface.

Oil painting, single coat, requires in labor .57 of an hour's time to the square of surface.

Paste Filler Coat, including cleaning of wood work, requires in labor 1.33 hours' time to the square of surface.

Varnish, single coat, including light sandpapering, requires in labor .66 of an hour's time to the square of surface.

Creosote staining of shingles by ⅔ dipping, requires in labor 1 hour of a mechanic's time to dip 1,000 shingles, which average to cover when laid, one square of roof surface.

Creosote staining, one brush coat on roof, requires in labor .8 hour's time to cover one square of surface.

Sizing of plaster walls with either glue or hard oil size requires in labor .33 of an hour's time to the square of surface.

Tinting with water color, fresco tints or calcimine averages to require in labor .44 hour's time to the square of surface to the man employed, providing not less than two men are employed on the work. (Ordinarily, one man cannot work alone at tinting of walls, for if he does so work, the work cannot be satisfactorily done and more time is required in proportion to the surface covered.)

Sponging and washing walls requires in labor a variable amount of time to the square according to the amount of size used in coat to be removed and must be approximated by the estimator after examination and test.

ILLUSTRATIVE CHARGES FOR CONTRACT WORK.

The following items illustrate some of the average charges made by contractors for material and labor at the time of going to press:

Whitewashing (machine applied) including material, labor and contractor's profit, about 27c per square, varying according to the size of the job, sometimes, in case of very large jobs, being figured as low as 8½c.

Whitewashing (hand brush applied), including material and labor and contractor's profit, about 55c per square.

Painting, two coat work, is estimated as worth $2.35 per square; itemized, 52c for all material and $1.83 for labor and profit.

Varnish work, including one coat of paste filler and two coats of varnish, is worth about $2.60 per square.

Sizing walls is worth about 75c per square for hard oil size.

Tinting walls, depending on color, averages to be worth 85c per square.

FIXED CHARGES.

The expenses of conducting the painting contracting business vary according to the efficiency of organization and range from 25 to 35 per cent of the cost of executing the work.

THE ESTIMATE.

After surfaces are measured and materials and labor are priced, as described above, and items totalled, about 30 per cent should be added to cover fixed charges and a percentage for profit, varying according to the reputation of the contractor, which will give the probable contract price of the work.

THE ORDERS AND THEIR APPLICATION.

By ALFRED W. S. CROSS, M. A., F. R. I. B. A , and ALAN E. MUNBY, M. A.

THE SETTING UP OF AN ORDER.

(To be studied in connection with Plates I., II., III., IV. and V.)

The sequence followed in setting up an Order will be found to influence, to some extent, the rapidity and facility with which it can be accomplished. An outline of the method of procedure may, therefore, prove useful.

Usually the height of the Order is fixed by circumstances, as, for example, when it is to be applied to a given story of a building.

The total height having been settled, draw the limiting horizontal lines and then set out the vertical centre lines of the columns, thus dividing the frontage to be treated into bays appropriate to the exigencies of the design and having due regard to the correct intercolumniation of the Order adopted. If a pedestal is to be placed under the column, cut off one-fifth of the total height for it, and cut off one-fifth or one-sixth of the remainder (measured from the top limiting horizontal line) for the vertical height of the entablature; the intervening space gives the height of the column, including its cap and base. If no pedestal is to be used, divide the whole of the given height into five or six parts, cut off one of these parts, from the top, for the entablature, and the remainder gives the height of the column.

The Column. Since some of the dimensions of the entablature are in terms of the diameter of the column, the latter should be next developed. The term "diameter of the column" refers always to its greatest diameter—namely, that of the shaft just above the lower cincture. This dimension is one-seventh to one-tenth of the height between the soffit of the entablature and the top of the pedestal, or lower limit of the Order in the absence of a pedestal. If the centre lines of the piers do not represent the centres of the columns, as, for instance, when coupled columns are used, the centre line of one of the columns must now be decided upon and the diameter of the Order symmetrically disposed horizontally across it. A semi-diameter is then cut off, from the bottom of the column, for the height of the base, and it should be noticed that this—except in the Tuscan and alternative Doric Orders—does not include the fillet at the base of the shaft, the members above the upper torus being reckoned as part of the shaft, as are also the astragal and fillet below the necking of the capital of the column. The plinth and lower torus of the base project one-third and the upper torus one-fifth of a semi-diameter beyond the lower circumference of the shaft. The leading lines for the base having thus been obtained, cut off by a horizontal line the height of the capital from the top of the column, and (except in the Ionic Order) again below it, a height equal to one-sixth of a semi-diameter for the astragal and fillet below the necking.

The semi-diameter of the shaft at one-third of its height from the bottom is then divided into five or six parts, and four or five of these parts are taken as a semi-diameter at the top, below the astragal. The shaft may now be completed, the entasis being usually made to start from the greater diameter, one-third up the shaft, below which point it is a true cylinder until the cincture at the base is reached. This is the best method to adopt in the case of small scale drawings. Where large detailed drawings are in question the diameter may be alternatively divided at the base of the shaft instead of at one-third of its height, and the entasis extended throughout the whole length. The completion of the shaft enables the projection of the capital to be marked off, and also that of the astragal and fillet, which is equal to their combined height.

The Entablature. The development of the entablature can now be proceeded with, the architrave, frieze and cornice being ruled off horizontally and the members of each inserted (see dimensions). The projections for a returned end or section are obtained from the upper diameter of the shaft. The lowest member of the architrave, and also the frieze, lie vertically over the circumference of this upper end of the shaft. The projection of the cornice beyond the frieze line is equal to its height, except in the Doric Order, in which the projection is one-third more than its height of one diameter. Further rules dealing with minor projections and the position of the modillions, dentils, etc., will be supplied by a study of the plates and tabulated dimensions.

Pedestal. Finally, the pedestal, if any, should be divided vertically into four parts; the lower part is ruled off for the height of the plinth, one-third of the second part for the height of the base, and one-half of the top part for that of the cap. The projection of the die is equal to that of the base of the column, and the plinth and the cap of the pedestal extends beyond this for a distance equal to the height of the base of the pedestal previously obtained.

The above dimensions will all be found in the subjoined table, which represents an endeavour to bring together, in a form suitable for reference, sufficient information to make any glaring disproportion impossible.

A few of the minor divisions are only approximations; they will, however, be found to be sufficiently accurate for any but large detail drawings, in which it is not desirable to destroy all individuality by rigorous mechanical rules.

On the left hand will be found the dimension required and, in the intermediate column the fraction for each Order of the previously ascertained unit given in the right-hand column.

Plate I.

Plate I. represents the four Orders drawn to a common vertical height.

The pedestal may or may not be required and, if used, it is to be regarded as an addition to the Order, the relative dimensions of the parts of which are not altered by its removal or introduction.

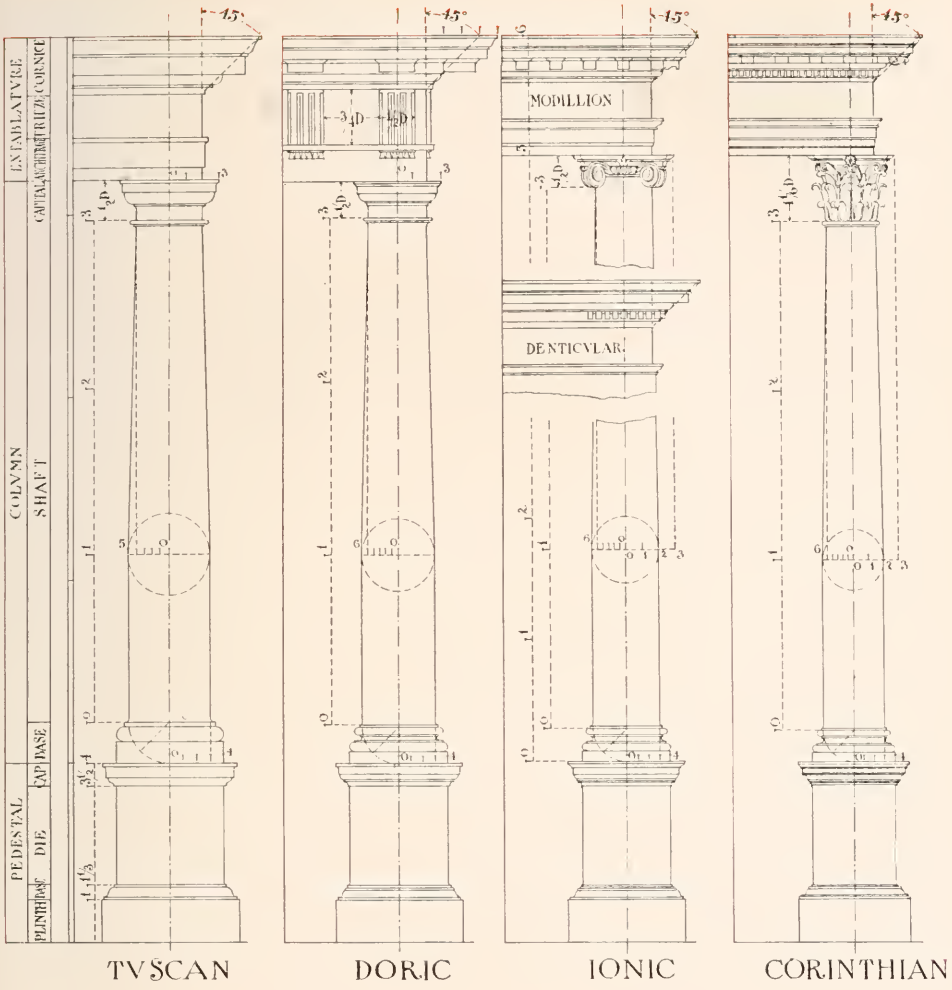
The diameter of the column (by which is meant the diameter of the shaft following its lower cincture) is the ruling dimension from which most of the others are obtained, and the smaller circumference of the top of the shaft always coincides with the frieze line from which all the projections of the entablature are set out.

In judging the value of such projections it should be borne in mind that in execution the higher vertical faces of the composition will usually be much foreshortened to the observer and that there will be a consequent increase in the comparative value of neighboring projections.

A perusal of the table will indicate those dimensions which all the Orders have in common, but for convenience of reference they are further summarized thus:

Height of Pedestal, ⅛ total height of Order.

PLATE 1.



Height of Plinth, ¼ height of Pedestal.

Height of Pedestal Base, ⅓ height of Pedestal Plinth.

Height of Pedestal Cap, ½ height of Pedestal Plinth.

Projection of Cap and Plinth, ⅓ height of Pedestal Plinth.

Projection of Corona over Die, ¾ projection of Pedestal Cap.

Height of Column Base, ½ dameter of Column.

Projection of Base over Shaft, ⅓ semi-diameter of Column.

Pilasters. The general proportions allotted to the columns of the Orders apply also to pilasters, which may be regarded as columns square on plan, but almost universally deeply engaged. The projection of pilasters must be regulated by circumstances. If impost mouldings or other projections stop upon them, as on the inner wall of an arcade, these projections must be sufficient to take the mouldings, and if they line with engaged columns crowned by an entablature, they must have a projection similar to the columns, and therefore in such cases never less than a semi-diameter. Apart from these considerations, the projection should be about one-fourth of the diameter. Pilasters may be fluted or plain; if the former, the flutes should be, as far as possible, the same size as those of the adjoining columns, and always an odd number.

* * *

On plain faces 7 flutes (occasionally 9) are used, and therefore in the above case 4 flutes (or 5) would be employed on each side of the re-entering angle. The returned sides of pilasters should never be fluted unless the projection is as much as half of a diameter. The diameter assigned to a pilaster will be that of a column (if any) used in conjunction with it. The shaft may or may not be diminished.

If the pilaster stand alone it is best formed with the same top and bottom diameter, but if a column stand in front of it then it should be diminished to the same extent as the column. Entasis is not usually given to pilasters.

Unless columns and pilasters are monoliths the shafts should be built up of three drums and not two, as a central joint, unless exceptionally well executed, has a very disagreeable appearance.

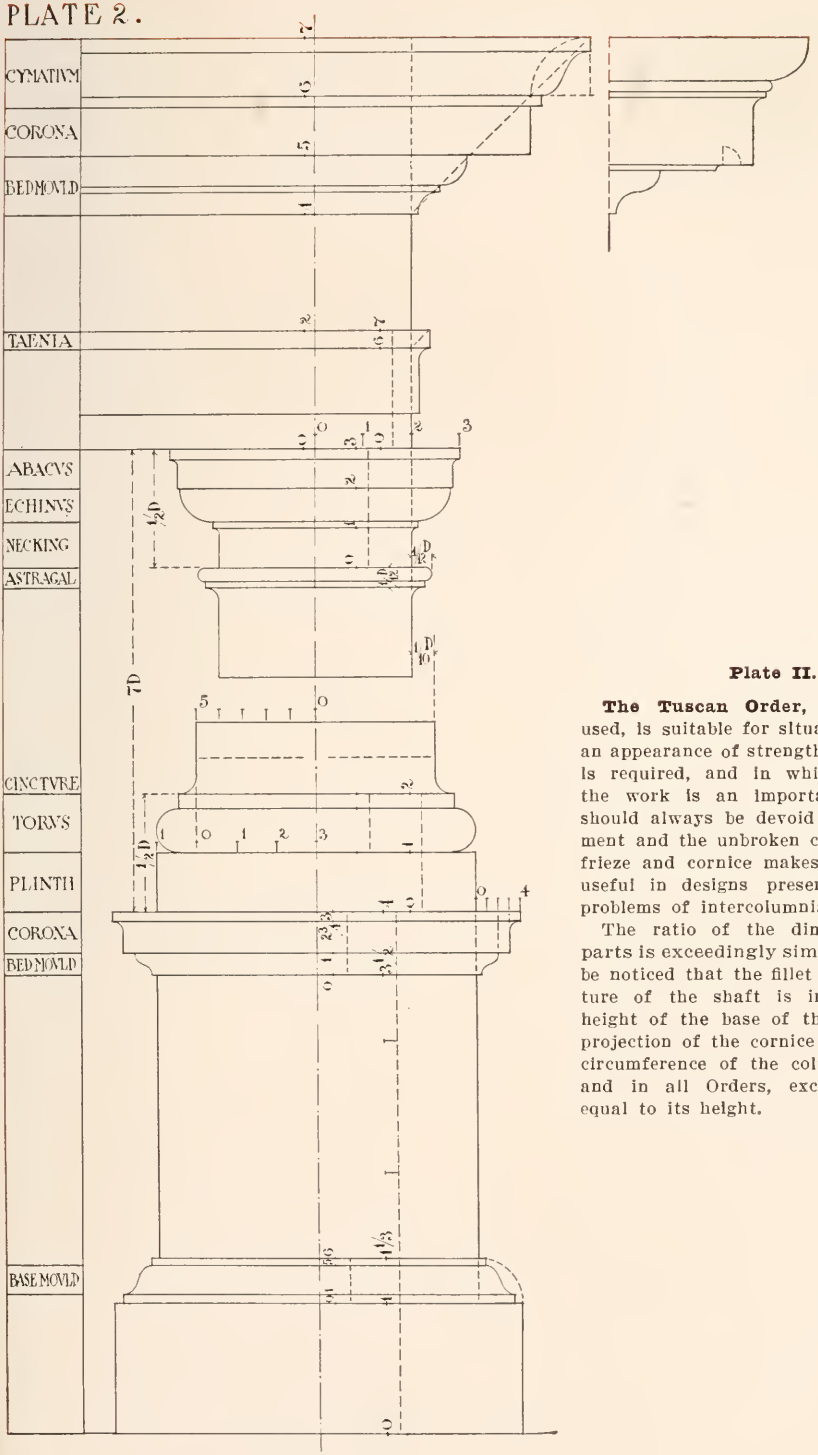
"Practical Notes for Architectural Draughtsmen: The Orders and their Application."

Tabulated Dimensions of the Orders. Arranged Progressively as Required for Use.

	Dimension required.	Tuscan.	Doric.	Ionic.	Corinthian.	Dimension = 1.
	No Pedestal — Height of Entablature	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	Total height of Order.
	With Pedestal — Height of Pedestal	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	" " "
	With Pedestal — Height of Entablature	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	Height of Order less Pedestal.
	THE COLUMN.					
Vertical.	Diameter of Shaft	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$	Height of Order less Entablature and Pedestal.
Vertical.	Height of Base	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Diameter of Shaft.
Vertical.	" Base Plinth	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	Height of Base.
Vertical.	" Lower Torus	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{10}$	" " less Plinth.
Vertical.	" Upper Torus	—	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{8}$	" lower Torus.
Vertical.	" Upper Torus and fillet under	—	1	1	1	" " "
Vertical.	" Capital	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{7}{8}$	Diameter of Shaft.
Vertical.	" Necking	$\frac{1}{5}$	$\frac{1}{5}$	To eye $\frac{1}{3}$	To 1st leaf about $\frac{1}{3}$	
Vertical.				Eye to abacus	$\frac{1}{3}$	Height of Capital (Corinthian less Abacus).
Vertical.	" Top of Neck to top of Ovolo	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{3}$	To 2nd leaf about $\frac{1}{3}$	" " " " "
Vertical.	" Abacus	$\frac{1}{5}$	$\frac{1}{3}$	$\frac{1}{3}$	2nd leaf to abacus about $\frac{1}{3}$	" " " " "
Vertical.	" Astragal and fillet	$\frac{1}{6}$	$\frac{1}{6}$	—	$\frac{1}{6}$	Semi-diameter of Shaft.
Vertical.	" Fillet below Astragal	$\frac{1}{3}$	$\frac{1}{3}$	—	$\frac{1}{3}$	Height of Astragal and Fillet.
Horizontal.	Projection of Base beyond Diameter	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	Semi-diameter of Shaft.
Horizontal.	" Upper Torus	—	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	" "
Horizontal.	Diminution of Shaft at Top	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	" "
Horizontal.	Projection of Cap over Shaft at Top	$\frac{1}{2}$	$\frac{1}{2}$	—	—	Semi-diameter of Shaft at Top.
Horizontal.	" Cap over Shaft at Base	—	—	$\frac{1}{2}$	$\frac{1}{2}$	Semi-diameter of Shaft.
Horizontal.	" Bead at top of Shaft	$\frac{1}{6}$	$\frac{1}{6}$	—	$\frac{1}{6}$	" "
	THE ENTABLATURE.					
Vertical.	Height of Architrave	$\frac{2}{7}$	$\frac{2}{8}$	$\frac{3}{10}$	$\frac{3}{10}$	Height of Entablature.
Vertical.	" Frieze	$\frac{2}{7}$	$\frac{3}{8}$	$\frac{3}{10}$	$\frac{3}{10}$	" "
Vertical.	" Cornice	$\frac{3}{7}$	$\frac{3}{8}$	$\frac{4}{10}$	$\frac{4}{10}$	" "
Vertical.	" Fillet and Cyma	$\frac{1}{3}$	$\frac{2}{6}$	Both fillets $\frac{1}{4}$	Both fillets $\frac{1}{5}$	" Cornice.
Vertical.	" Corona and Fillet over	$\frac{1}{3}$	$\frac{2}{6}$	$\frac{1}{4}$	$\frac{1}{5}$	" "
Vertical.	" Base of Corona to top of Ovolo	—	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{5}$	" "
Vertical.	" Top of Ovolo to Frieze	$\frac{1}{3}$	$\frac{2}{7}$	$\frac{1}{4}$	$\frac{1}{5}$	" "
Horizontal.	Total projection of Architrave over top diam. of Shaft	$\frac{4}{7}$	$\frac{5}{6}$	$\frac{1}{4}$	$\frac{1}{5}$	" Architrave.
Horizontal.	" top face of Architrave " "	$\frac{1}{5}$	$\frac{2}{5}$ (guttae)	$\frac{1}{4}$	$\frac{1}{5}$	Total projection of Architrave.
Horizontal.	" of Cornice over Frieze	1	$\frac{4}{5}$	1	1	Height of Cornice.
Horizontal.	" Inset of Corona from top of Cornice	1	$\frac{5}{6}$	1	1	" Fillet and Cyma of Cornice.
Horizontal.	" Length of Modillions (or Mutules)	—	$\frac{1}{2}$	$\frac{1}{4}$	(and ogee) $\frac{1}{3}$	Diameter of Column.
Horizontal.	$\frac{1}{2}$ Breadth of Modillions (or Dentils)	—	(triglyph) $\frac{1}{2}$	M. $\frac{1}{6}$ D. $1\frac{1}{2}$	$\frac{1}{6}$	" "
Horizontal.	$\frac{1}{2}$ Space between Modillions (or Dentils)	—	(metope) $\frac{3}{4}$	M. $\frac{1}{4}$ D. $2\frac{1}{4}$	—	" "
	THE PEDESTAL.					
Vertical.	Height of Plinth	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	Height of Pedestal.
Vertical.	" Base	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	" Plinth.
Vertical.	" Cyma of Base	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{2}$	(and fillet) $\frac{1}{2}$	" Base.
Vertical.	" Fillet below Cyma	1	1	1	1	Fillet above Cyma.
Vertical.	" Cap	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Height of Plinth.
Vertical.	" Base of Corona to top of Cap	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	" Cap.
Horizontal.	Projection of Cap and Plinth over Die	1	1	1	1	" Base of Pedestal.
Horizontal.	" Corona of Cap over Die	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	Projection of Cap over Die.

Note.—The "Diameter" is always the greatest diameter of the drum of the Column. M. refers to the Modillion Cornice. D. to the alternative Dentil Cornice.

PLATE 2.

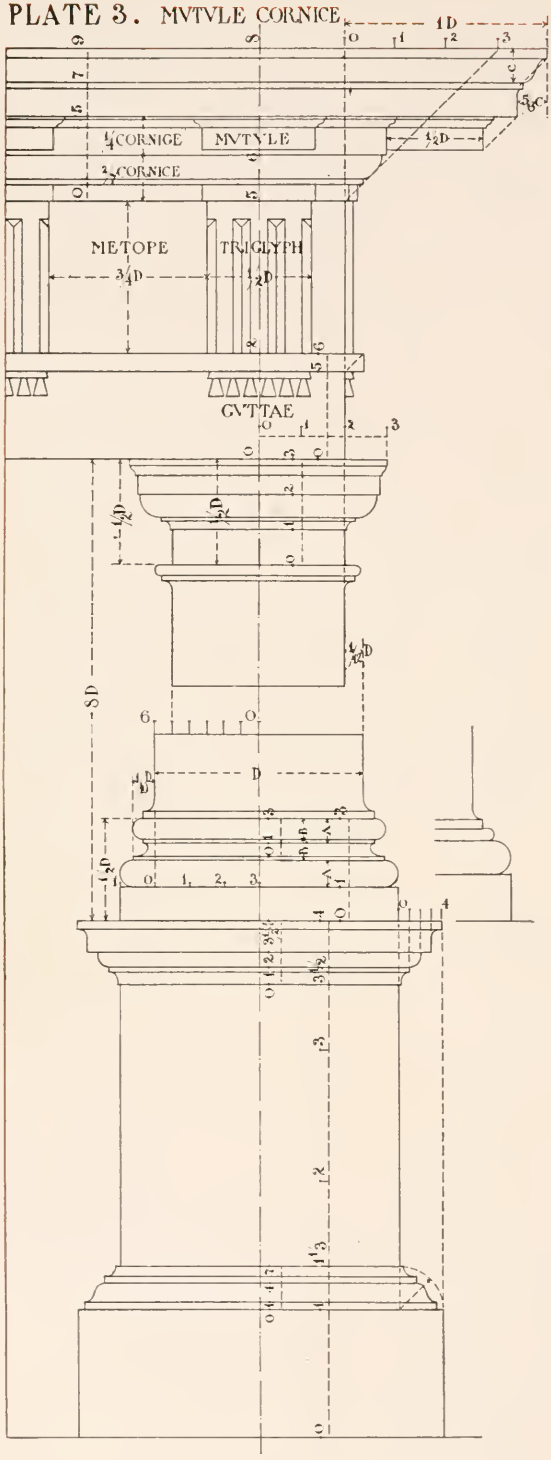


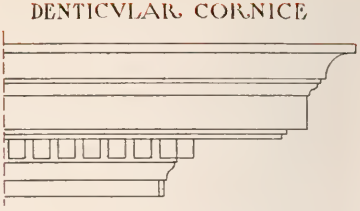
TVSCAN

Plate II.

The Tuscan Order, though seldom used, is suitable for situations in which an appearance of strength and simplicity is required, and in which the cost of the work is an important factor. It should always be devoid of any enrichment and the unbroken character of the frieze and cornice makes it particularly useful in designs presenting awkward problems of intercolumniation.

The ratio of the dimensions of its parts is exceedingly simple. It should be noticed that the fillet below the cincture of the shaft is included in the height of the base of this Order. The projection of the cornice over the upper circumference of the column is, in this and in all Orders, except the Doric, equal to its height.





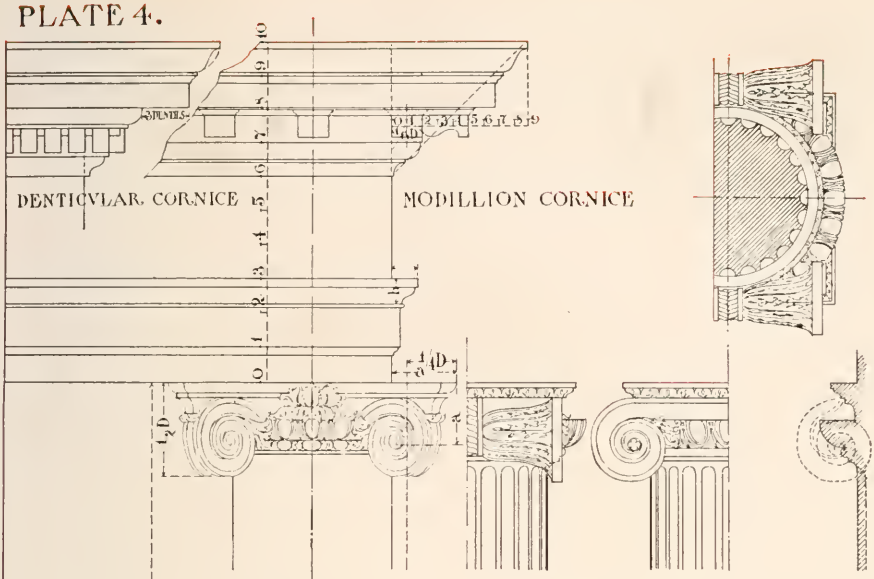
DORIC

Plate III.

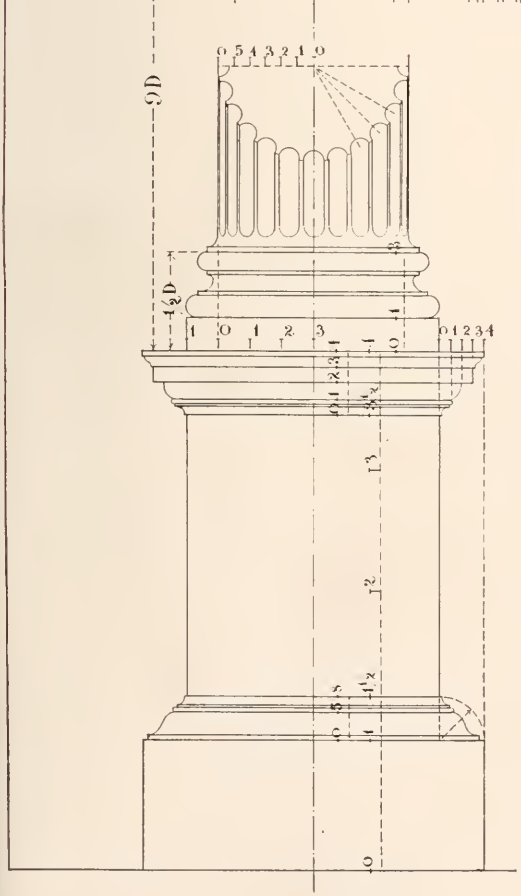
The Doric Order is always effective when used in lower storeys, arcades, and door and window openings, but owing to the triglyphs upon the frieze, which must fall centrally over the columns, it is the most difficult to deal with when spacing is in question.

The dimensions of the cornice do not lend themselves to any simple ratio and its projection is always greater than that adopted for the other Orders. The 45° line from the top of the frieze at once gives the bed mould of the mutule course, and one-third of the height of the cornice added to the top projection of this guiding line gives the total projection, while the mutules are one-half a diameter in side elevation. Some considerable modifications of the Order, as here represented, will be found to exist in many recognised examples. Occasionally the mutules are dispensed with, and their bed mould is cut to form a dentil course, as in the Theatre of Marcellus. The cyma crowning the cornice is often replaced by a cavetto, while the Doric base (shown alternatively on the plate) sometimes replaces the more graceful attic base. When this base is used, the upper fillet should be included in the height of the base, as in the Tuscan Order.

PLATE 4.



CVSHION CAPITAL



IONIC

Plate IV.

The Ionic Order shows smaller variations from the pure Classic examples than any other, and its proportions are fairly simple.

Two styles of cornices are, however, used, the modillion and the dentil cornice, and although the method adopted by Gibbs of giving prominence to the former has been followed, it should be stated that the latter is more generally found in old examples, whilst the former is preferred by Palladio.

Represented side by side upon the plate the extent of the variation is easily discernible. A modillion or dentil should always be bisected by the centre line of the column and the spacing determined by the distance of this line from the frieze, as set out upon the drawing. The frieze is always plain and in larger works it is, preferably, kept flat. In smaller compositions, however, when narrow or when used over doors and windows a pulvinated frieze may be adopted with good effect.

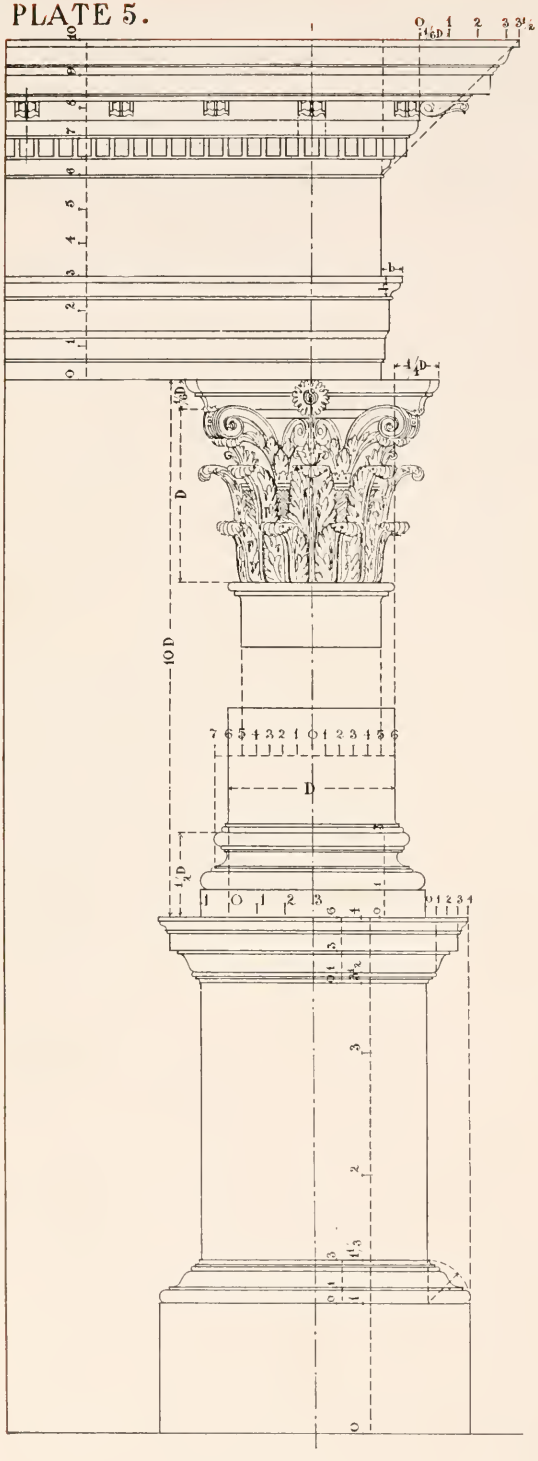
The earlier alternative form of the Ionic capital in which the faces of the volutes are parallel to the plane of the elevation (not shown upon the drawings) may, of course, be substituted for the capital with angle volutes at 45°, though the latter has usually a much more graceful effect, particularly in small compositions. Of course, the geometrical method for setting out the volutes cannot be used in drawing such capitals in ordinary elevation. It should be noticed that the height of the capital in this Order is measured from the soffit of the volutes.

The centre of the eye is one-third of the height of the capital from its bottom and is in elevation placed just outside the top circumference of the shaft, while the horizontal fillet at the top of the shaft is immediately below the eye.

When the column is fluted the width of the fillets should be one-fourth to one-third that of the flutes. The flutes generally number twenty or twenty-four; in the latter case the simple method of setting them out on plan, as shown on the drawing, will be found of service.

The attic base is always used with the Ionic Order.

PLATE 5.



CORINTHIAN

Plate V.

The Corinthian Order has been represented with considerable variations from the original type.

The Ionic entablature was often used by the ancients, supported by Corinthian columns, and the Corinthian cornice itself, though here represented with a dentil band, is often found without one. No general rule appears to exist for spacing the modillions or for their dimensions, the ratio of the width of the modillion to the space between two of them varying from 1 : 1½ to 1 : 2½, and again the number of the dentils between the modillions varies from 2 to 5 in different examples.

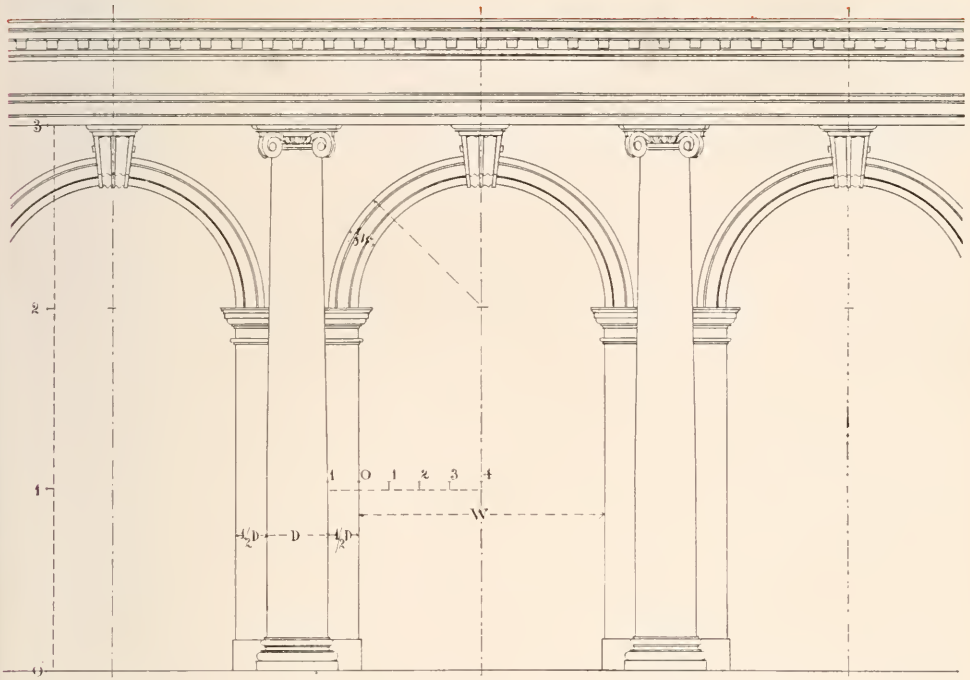
Both features should be symmetrically placed with reference to one another and to the centre line of the column, a point often neglected. To secure this result the following method is recommended :— Draw a modillion one-sixth of the diameter of the column in width, arranged symmetrically over the centre line of the column. Place another with its outside edge three and a half times its width within the total projection of the cornice and thus obtain the spacing between the blocks. Divide the distance between two modillion centres into 15 parts, give two to a dentil, to be placed symmetrically under a modillion, and one to each space between the dentils, which will be found to bring the inside edge of the last dentil before the return, on the frieze line.

The form and projection of the leaves of the capital are largely matters of individual taste, but the general method of their arrangement will be evident after examining the drawing. It may, however, be noted that the eye of the volute is just outside the lower circumference of the shaft, and that the tiers of leaves divide the capital below the abacus into three approximate equal horizontal sections.

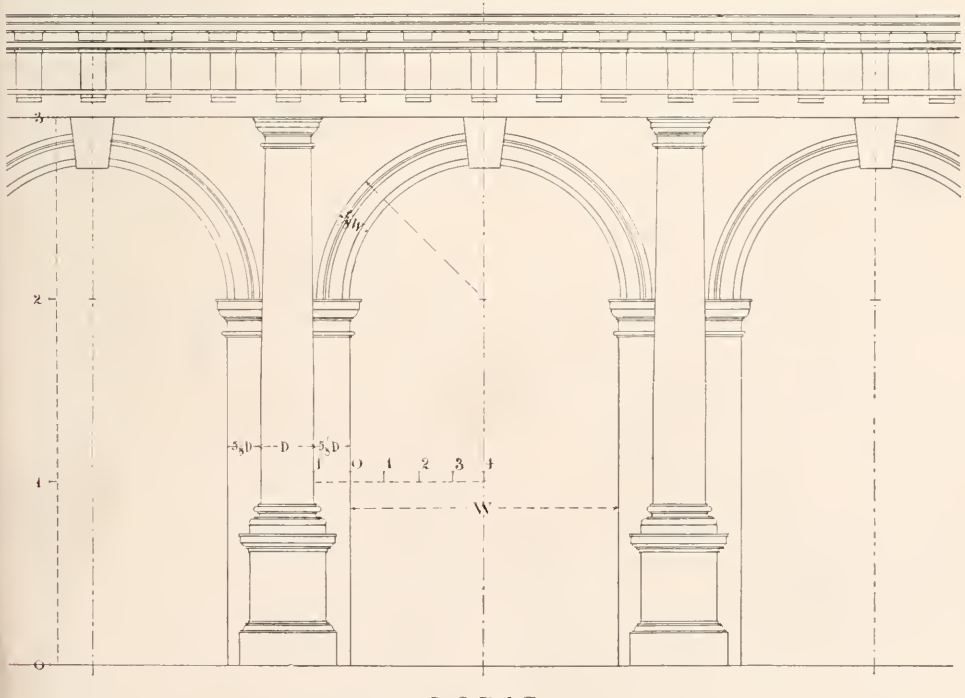
The column may or may not be fluted as in the Ionic Order.

The attic base, as used in the Ionic Order, is very generally employed—in fact, it is often preferable to adopt it, omitting the additional mouldings shown, for the sake of variety, on the drawing.

PLATE 6.



IONIC



DORIC

Plate VI.

The relations and dimensions given in this and similar subsequent plates must, therefore, be looked upon as necessarily somewhat elastic. At the same time, such dimensions as are given should not be disregarded, but considered in the light of proportions to be attained as far as the exigencies of the plan will admit.

The spacing of arcading dealt with in this plate should be governed by the height of the space to be treated, and it will be found that the best effects are obtained when the widths of the openings approximate to half of their height, and when the total width of the piers lies between one-half and two-thirds of that of the opening.

The spacing must also be considered in reference to the Order employed, so that when triglyphs, or modillions, are placed centrally over the columns their proper spacing may be interfered with as little as possible. It will thus be seen that a relation exists between the diameter of the column, the width of the pilaster, and the width of the opening. Again, the diameter of the column relatively to the opening will be influenced by the presence, or absence, of a pedestal to the Order. The summary shown, collected from Gibbs's work, giving the dimensions to be aimed at in order to comply with the above relations, will be found useful:

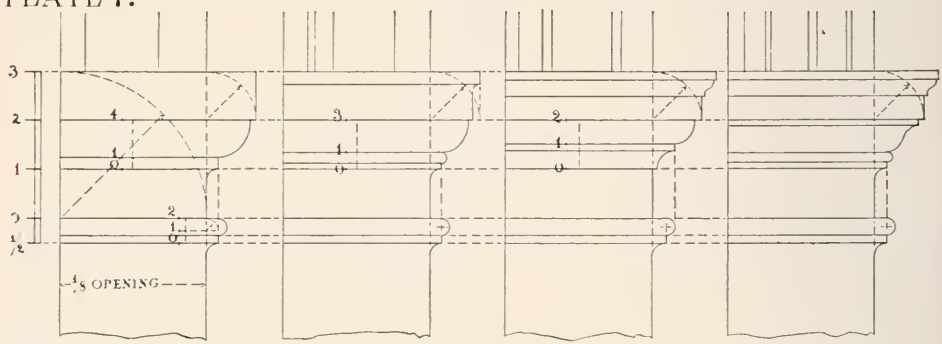
The height of the impost should always be about two-thirds of the height from the ground to the soffit of the architrave of the Order, whether a pedestal is in use or not.

Diameter of Column = 1.

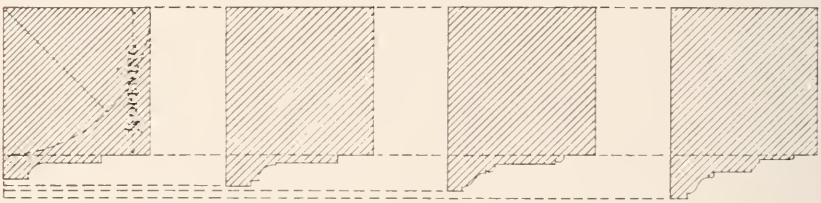
	Tuscan.		Doric.		Ionic.		Corinthian.	
	No Ped.	With Ped.	No Ped.	With Ped.	No Ped.	With Ped.	No Ped.	With Ped.
Width of bay centre to center	6	7	6¼	7½	6	7½	6 5-12	8⅛
Width of one pilaster	½	⅔	½	⅝	½	⅝	⅝	7-10
Width of opening	4	4⅔	4¼	5¼	4	5¼	4⅓	5⅗

The archivolt or moulding running round the arch should be the same width as the pilaster (less any necessary clearance for the mouldings) —that is, about one-eighth of the width of the opening, which should also be the height of the impost cap to the bottom of the necking. Further details as to the members will be found on Plate VII.

PLATE 7.



IMPOSTS AND ARCH MOVLDS



TVSCAN DORIC IONIC CORINTHIAN

Plate VII.
Impost Mouldings.

Details are here given of impost mouldings, with their archivolts, suitable for the different Orders. The divisions of the imposts are all simple and similar in each example, the height of the corona and of its mouldings above, if any, being equal to the height of the mouldings below, which, again, are equal to the necking. The bead and fillet below the necking are one-sixth of the height of the impost, the bead being double the height of the fillet. The projection of the impost beyond the line of the pilaster is equal to the height of the corona and member over in the first two Orders, while the projection of the corona itself is equal to this height in the last two.

The pilaster is square on plan, and, therefore, the plan of the archivolt is represented by this square upon which the mouldings are placed. An examination of these mouldings will show that they resemble the architraves given for their respective Orders, and their forms admit of similar variations. It will be noticed that the innermost face is always in the plane of the face of the pilaster, while the projection of the moulding at the extrados increases from about one-quarter the width of the whole archivolt in the Tuscan to one-third in the Corinthian Order.

SUBJECT INDEX.

System of Classification for Filing Data, Drawings, Plates, Catalogues, Etc., in Architects' and Contractors' Offices.

INTRODUCTION.

The decimal system of classification was devised and elaborated by Mr. Melvil Dewey, formerly director of the New York State Library. This system was intended primarily for the use of librarians in the classification and arrangement of books and pamphlets, but it was soon found that the system furnished also a simple and effective means of classifying, indexing and filing literary matter of all kinds. Engineers have found it useful for indexing technical data and information, catalogs, reports, card systems, drawings, etc., and it has been found equally useful by manufacturing and business concerns.

Much of the following information is taken from the University of Illinois Engineering Experiment Station, Bulletin No. 9, prepared by L. P. Breckenridge, Professor of Mechanical Engineering, and G. A. Goodenough, Associate Professor of Mechanical Engineering, and Bulletin No. 13 by N. Clifford Ricker, D. Arch. Professor of Architecture.

EXPLANATION OF THE DECIMAL SYSTEM.

The essential characteristic of the Dewey System is its method of division and subdivision. The entire field of knowledge is divided into nine chief classes numbered by the digits from 1 to 9. Matter of too general a nature to be included in any of these classes is put into a tenth class and indicated by 0. The following are the primary classes of the Dewey System:

0 GENERAL WORKS
1 PHILOSOPHY
2 RELIGION
3 SOCIOLOGY
4 PHILOLOGY
5 NATURAL SCIENCE
6 USEFUL ARTS
7 FINE ARTS
8 LITERATURE
9 HISTORY

Each of these classes is again divided into nine divisions, with a tenth division for general matter, and each division is separated into nine sections. The sections are again sub-divided and the process may be carried as far as desired.

It is thought that this system will be especially valuable to architects for classifying drawings, catalogs, reports and technical data. Our space is too limited to publish the complete work, nor is it desirable. Should any one be sufficiently interested to go into the matter thoroughly, they should have Mr. Dewey's complete text on the subject. In order to make the application of the system clear in the briefest possible way, the miscellaneous information contained in this book has been assumed to comprise a small architect's library and has been classified according to the Dewey System. It is hoped that this will make clear the practical application to architects' libraries, both large and small. In succeeding years, we hope to be able to publish a more extensive relative index in which the items of the classification are arranged alphabetically, the one at present published only covering the items of miscellaneous information contained in this book, with some of the more important general topics. We are particularly concerned as practitioners of the profession of architecture with divisions 6 and 7, "Useful Arts" and "Fine Arts," comprising the following subject numbers:

600 USEFUL ARTS
610 MEDICINE
620 ENGINEERING
630 AGRICULTURE
640 DOMESTIC ECONOMY
650 COMMUNICATION AND COMMERCE.
660 CHEMICAL TECHNOLOGY
670 MANUFACTURES
680 MECHANIC TRADES
690 BUILDING

Omitting all sub-divisions of this topic, with the exception of **690 "Building,"** we publish the sub-divisions of same. As distinguished from **"Architectural Construction," "Building"** has to do more particularly with the processes of construction and matters pertaining to trades and materials involved in the construction of buildings should be more properly classified under "Building", while matters as to types and component architectural parts are more properly classified under **Architectural Construction.**

690 BUILDING — MATERIALS — TRADES.
See 721. for Architectural Construction, and 729. for Architectural Forms of Design.

.0 GENERAL.
690.01 Biography of Builders.
.02 Finance of Buildings.
.03 Operation of Buildings.
.1 THEORIES OF CONSTRUCTION.
.11 Systems of Construction.
.12 Engineering of Construction.
.2 SUMMARIES OR COMPENDS.
.21 Manuals; .22, Handbooks.
.23 Receipts, Collections of.
690.3 ALPHABETICALLY ARRANGED KNOWLEDGE.
.31 Cyclopedias; .32, Dictionaries.
.4 DISSERTATIONS.
.41 Lectures; .42, Discussions; .43, Essays.
.5 PERIODICALS.
.51 Daily; .52, Weekly; .53, Monthly; .54, Quarterly; .55, Annual.
.6 SOCIETIES; PROCEEDINGS.
.61 Trade Unions.
.62 Exhibitions.
.621 Materials; .622, Methods; .623, Construction.
.63 Contractors' Associations.
.631 Estimators' Clubs.
.64 Engineering Societies.
.65 Inspectors' Associations.
.66 Material Dealers' Associations.
.67 Manufacturers' Associations.
690.7 Education and Study.
.71 Training of Workmen; .72, Apprenticeship; .73, Tools and Their Uses (see special trade for special tools); .74, Shop Practice; .75, Trade Schools; .76, Manual Training.
690.8 Museums.
.81 Collections; .82, Patents; .83, Inventions; .84, Machines for Manufacturing; .841, Wood; .842, Stone; .843, Steel and Iron; .844, Bricks; .845, Tiles; .846, Cement and Lime; .847, Concrete; .848, Asphalt; .849.
.9 History of Building Materials.
.91 Ancient; .92, Mediaeval; .93, Renaissance; .94, Modern; .95, History of Building Construction; .951, Ancient; .952, Mediæval; .953, Renaissance; .954, Modern.

691. Materials; Processes; Preservatives.
See 620.1 for Strength of Materials. See 693. to 699. for Uses of Prepared Materials. If the user prefers, he may classify all his material on Building Engineering under 690.12.)
.1 Woods.
.11 Hard Conifers.
.12 Soft Conifers.
691.13 Hard Leaf Woods.
.14 Soft Leaf Woods.
.15 Defects of Woods and Grading.
.16 Injuries to Woods.
.17 Preservation of Woods.
.2 Stone; Material; Protection.

691

.29 **Preservation.**
.3 **Stone, Artificial; Concrete.**
.31 Beton Coignet; .32, Ransome; .33, Hollow Block; .34, Selenitic; .35, Lime Concrete; .36, Cement Concrete; .39, Aggregate.
.4 **Ceramic Products.**
.41 **Bricks.**
.42 **Tiles.**
.432 **Flooring.**
.441 **Wall Tiles.**
.45 **Hollow Structural Tiles.**
.451 **Floor.**
.452 **Roof and Ceiling Tiles.**
.453 **Wall Tiles.**
.1 Wall Linings; .2, Bond Courses; .3, Partition.
.46 **Terra Cotta.**
.48 **Sewer Tiles.**
.5 **CEMENTING MATERIAL.**
.51 **Lime.**
.52 **Cement.**
.53 **Asphaltum.**
.54 **Glue.**
.55 **Other Cementing Materials.**
.6 **GLASS, SHEET, PLATE, CATHEDRAL, OPALESCENT, PRISMATIC.**
.7 **Iron; Steel; Anti-Rust Processes.**
.71 **Cast Iron; .72, Malleable Cast Iron; .73, Wrought Iron; .74, Steel, Blister or Tool; .75, Steel, Crucible; .76, Steel, Bessemer; .77, Open Hearth; .79, Protection of Iron and Steel;** .791, Painting; .792, Tinning; .793, Zincking (galvanizing); .794, Electroplating; .795, Bower-Barff Process; .796, Cement Coating; .797; .798; .799.
.8 **Other Metals.**
.81 **Copper.**
.82 **Nickel.**
.83 **Zinc.**
.84 **Lead.**
.85 **Aluminum.**
.86 **Tin; .861, Tin-coated Iron.**
.87 **Silver.**
.88 **Gold.**
.89 **Metallic Alloys; .891, Bell-Metal; .892, Brass; .893, Bronze.**
.9 **OTHER MATERIALS.**
.92 **Fibriform;** .921, Hair; .2, Jute; .3, Hemp; .4, Flax; .5, Wool.
.93 **Paper;** .931, Sheathing; .2, Quilt; .3, Slating; .4, Roofing; .5, Wall Paper; .6, Board.
.94 **Fabrics, Woven;** .941, Duck; .2, Burlap and Buckram; .3, Carpet; .4, Rugs; .5, Linings; .6, Shades; .7, Curtains and Hangings.
.95 **Asbestos, Serpentine;** .951, Asbestos Cloth; .2, Plaster; .3, Moulded Sections; .4, Fiber, Loose; .5, Asbestos-Magnesia; .6, Asbestos Board; .7, Asbestos Shingles.
.96 **Bitumen;** .961, Asphalt, Hard, Solid, Brittle; .2, Meltha or Mineral Tar; .3, Petroleum; .4, Naphthas.
.965 **Asphalt Products;** .1, Paint; .2, Water-Proofing; .3, Cement; .4, Paving .5, Roofing Cement.
.966 **Coal-Tar;** .6961, Pitch; .2, Roofing Cement; .3, Mill-Board; .4, Felt.
.967 **Wood-Tar;** .6971, Pitch; .2, Resin; .3, Varnish; .4, Cement.
.97 **Pelt;** .1, Roofing; .2, Deafening, .3, Insulating.
.98 **Compositions;** .981, Cork Carpet; .2, Linoleum.

692 PLANS; SPECIFICATIONS; ESTIMATES.

.1 **General Drawings; .10, Drafting Room Supplies.**
.11 **Plan, Location; .12, Plan, Foundation; .13, Plans, Floor; .14, Plan, Roof; .15, Elevations;** .151, Front; .152, Side; .153, Rear; .154, Court; .159.
.16 **Sections;** .161, Longitudinal; .162, Cross; .169, Special.

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.19 **Other General Drawings.**
.2 **DETAIL DRAWINGS.**
.21 **Masonry.**
.22 **Woodwork.**
.23 **Metal Work.**
.24 **SANITARY AND ILLUMINATING EQUIPMENT.**
.25 **Heating and Ventilating.**
.26 **Plastering.**
.27 **Roofing Composition.**
.28 **Glass Work.**
.29 **Other Drawings.**
.3 **SPECIFICATIONS.**
.30 Title Page, General Conditions, Etc.; .301, Excavation and Grading; —02, Mason Work, Fire Proofing and Structural Concrete (See 693.); —03, Cut Stone (See 693.); —04, Terra Cotta (See 693.); —05, Concrete, Walks and Floors (See 693.); —06, Structural Iron; —061, Ornamental Iron (See 694.9); —07, Fire Escapes (See 694.927); —08, Carpenter Work and Rough Hardware (See 694.1 to 8); —09, Cabinet Work (See 694.7); —10, Sheet Metal Work, Slate and Tile Roofing (including metal frames, wire glass and skylights) (See 695.2); —11, Composition Roofing (See 695.6 to 8); —12, Drainage, Sewerage and Plumbing (See 696.1 to 6); —13, Gas Fitting (See 696.7); —14, Electric Wiring, Telephones, Bells, and Speaking Tubes (See 696.91 to 9); —15, Electric Power Machinery; —16, Power Equipment other than Electrical; —17, Heating and Ventilation (See 697.1 to 9); —18, Pipe Covering (See 697.46, also 691); —19, Plastering, 1 Plain and 2 Ornamental (See 693.9); —20, Glazing, 1 Sheet Glass, 2 Plain Glass, 3 Mirrors (See 698.5); —21, Art Glass (See 729.8, also 691.); —22, 1 Painting, 2 Varnishing, 3 Staining (See 698.); —23, Decoration of Walls, Painted and Hung (See 698.); —24, Tile, Mosaic and Marble (See 729.7); —25, Mantels and Consoles (See 729.95 and 694.7); —26, Finish Hardware (See (694.24); —27, Elevators, Dumb Waiters, Parcel Lifts and Conveyors; —28, Gas Range (See 696.63); —29, Refrigerating Equipment (See 696.62); —30, Shades, Curtains and Hangings for Openings (See 729.97); —31, Carpets, Rugs, Etc.; —32, Screens (See 721.875); —33, Lighting Fixtures (See 729.99); —34, Furniture, including Seating, Tables, Desks, Etc. (See 729.92); —35, Organs (See 729.98); —36, Landscape Gardening (See 710.).
.4 **Contracts. Agreements. Bids. Advertisements.**
.5 **Estimates. Quantities. Cost.**
.51 By Cubical Contents.
.52 By Square Foot Floor Area.
.53 By Trades or Units, divided as 692.3.
.6 **Superintendence.**
.7 **Supervision of Accounts.**
.8 **Professional Services. Fees. Commissions.**
.9 **Building Laws. Liabilities of the Architect, Owner and Contractor.**
.91 State or General Laws.
.92 City Ordinances.
.93 Town or Village Ordinances.
.94 Trade Rules.
.95 Liabilities of Architects.
.96 Liabilities of Owners.
.97 Liabilities of Contractors.
.98 Lien Laws.

693 MASONRY, PLASTERING, FIREPROOFING.

.01 **Mortar .02 Solids .03 Metal.**
.1 **Stone Construction.**
.11 Bond Stone Work.

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.12 Cutting and Dressing of Stone (See 515.8, Stereotomy; 736, Stone Carving).

.2 Brick Construction.

.21 Bond of Brick Work.

.22 Adobe or Sun Dried Brick.

.3 Terra Cotta Construction.

.4 Fire-proofing. Hollow Tile and Porous Terra Construction.

.5 Concrete and Beton or Sub-marine Construction.

.51 Massive.

.52 Layers.

.53 Hollow Blocks.

.54 Sidewalks; 541, Methods; .542, Vault Covers and Doors; .543, Vault Lights.

.55 Ornamental.

.6 Reinforced Concrete.

.61 Systems, arranged alphabetically.

.62 Forms and Centers.

.63 Testing and Inspection.

.64 Data from Experiments.

.65 Formulas.

.66 Special applications.

.7 Marble, Tile and Mosaic. Sanitary Composition.

.71 Systems, arranged alphabetically.

.8 Water-proofing.

.81 Systems, arranged alphabetically.

.9 Plastering.

.91 External Plastering and Stucco.

.92 Internal Plastering.

.93 Ornamental Plastering.

.94 Scagliola.

.95 Wooden Lath.

.96 Metal Lath and Furring. Studs, Corners.

.97 Mineral Wool Linings.

.98 Plaster Board and Compo Board.

694 FRAMED & BOXED CONSTRUCTION, CARPENTRY & METAL WORK.

.1 WOOD CONSTRUCTION IN GENERAL, INC. PAPER BOARD.

.11 Ordinary.

.111 Balloon Const. for Frame Buildings.

.112 Joist Const. for Masonry Buildings.

.12 Heavy Timber Construction.

.121 Heavy Post and Timber Const. for Frame Buildings.

.122 Mill Const. for Masonry Buildings.

.13 Auxiliary Wood Const. for Fire-proof Buildings.

.131 Centering, Forms, Protective Covering.

.132 Grounds, Attachment Strips, etc.

.2 JOINTS OF WOOD-WORK, FRAMING, ATTACHMENTS.

.21 Wood-Pins; 2, Tenons; 3, Mortise; 4, Dove-tail; 5, Splice, etc.

.22 Glue, Cement, etc.

.23 Metal Formed Joints, Concealed Rough Hardware.

.231 Nails, Spikes.

.232 1, Bolts and Rods; 2, Rivets; 3, Washers, Flitch-plates; 4, Stirrups, Anchors, Hangers, Ties, Box and Wall Anchors and Plates, etc.; 5, Coal Chutes. Metal Chimney Caps.

.233 1, Pivots; 2, Hinges; 3, Pulleys; 4, Cords and Chains; 5, Weights, etc.; 6, Door Hangers; 7, Turn Tables.

.24 Exposed Metal-formed Joints and Protections, Finish Hardware.

.241 Hinges, Butts, Hooks, Latches, Bolts, Locks, Escutcheons, Roses, Key-plates, Kick-plates, Pulls, Sockets, Lifts, etc.

.242 Bumpers, Strikes, Angle Covers, Holders, etc. Weather Strips, Thresholds, Treads for Stairs.

.243 Closing Mechanism Springs, Spring-checks, etc.

.244 Step-ladders.

.245 Carriers of Merchandise, Elevators.

.246

.247

.248 Show Cases.

.249

694.3 **STRENGTHENED BEAMS.**

.4 POSTS, COLUMNS (See 721.31).

.5 PANELED AND LATTICED CONSTRUCTION, HALF TIMBER WORK.

6 JOINERY, GENERAL MILL WORK.
1, Frames; 2, Sash; 3, Doors, Panel, Revolving and Rolling; 4, Blinds; 5, Screens; 6, Trim; 7, Flooring.

.7 ORNAMENTAL JOINERY, CABINET WORK.
1, Cabinets, Cases, etc. (See 729.9).

.8 STAIR BUILDING (See 515.83 Stereotomy).

.9 METAL WORK.

.91 Structural.

.911 Material (See 691.7).

.912 Cast.

.913 Wrought.

.914 Rolled.

.915 Connections.

.92 Ornamental.

.921 Material (See 691).

.922 Cast.

.923 Wrought.

.924 Drawn.

.925 Guards and Grilles, Enclosures, Solid Metal Sash.

.926 Stairs.

.927 Fire-Escapes.

694.928 **Vault Doors.**

695 SHEET, SHINGLE & COMPOSITION COVERING, OVERLAYING CONSTRUCTION.

.1 WOOD SHINGLES (See 694.1).

.2 Sheet Metal and Allied Const.

.21 Materials (See 691); .22, Specifications for (See 692.3-10); .23, Cost of (See 692.53-10).

.24 Formed Sheet-metal.

.241 Moulded Work, Spun and Hammered Ornaments, Ventilator Caps and Ducts.

.242 Utensils, Cans, etc.

.242 Sky-light bars.

.243 Window Frames and Sash, Sheet Metal Doors, Hinged, Rolling and Sliding.

.244 Glass for Sky-lights and Fire-proof Windows.

.25 Shingles of Metal, Slate or Composition.

.251 Kinds of, arranged alphabetically.

.252 Tests, Sizes, Preservatives.

.26 Tile of Metal, Slate, Terra Cotta or Composition.

.261 Kinds of, arranged alphabetically.

.27 Corrugated and Stamped Metal Roofing and Siding.

.28

.29

.3 STAMPED METAL WALL AND CEILING DECORATIONS.

.31 Kinds of, arranged alphabetically.

.4 Sheet Metal Trim. and Furniture.

.5

.6 COMPOSITION.

.61 1, Asphalt; 2, Tar; 3, Concrete, Melted.

.62 1, Felt; 2, Asbestos; 3, Paper; 4, Mineral Wool; 5, Canvas.

.7 DEAFENING FELTS AND QUILTS.

.8 TEXTILE DUCK, CANVAS, BURLAP.

9. THATCH AND OTHER COVERINGS.

696 SANITARY EQUIPMENT, ILLUMINATION (Drainage, Sewerage, Plumbing, Gas-Fitting, Electric Lighting).

.1 DRAINAGE.

.2 SEWERAGE.

.21 Sewer Pipe.

.22 Catch Basins.

.23 Garbage Disposal.

.24 Soil and Waste Pipe.

.3 PLUMBING.

.4 WATER SUPPLY.

.41 Cold Water.

.411 Pumps.

696.413 Tanks; 4, Hose; 5, Fire Protection; 6, Filters; 7, Sterilizers; 8, Ice Machinery; 9, Stills, etc.
.42 **Hot Water.**
.421 Boilers, Tanks.
.422 Heaters, Coal, Gas, Garbage Burners.
.5 **JOINTS. ANCHORS. SUPPORTS. PIPE.**
.6 **FIXTURES FOR PLUMBING.**
.61 Water Closets, Lavatories, Sinks, Wash-trays, Baths, etc.
.62 Refrigerators, Water Coolers.
.63 Gas Ranges, Clothes Dryers, Laundry Machinery.
.64 Brass Goods.
.7 **GAS FITTING** (for fixtures, see 729.99).
.8 **OTHER BRANCHES. PNEUMATIC CLEANING.**
.9 **ELECTRIC EQUIPMENT FOR ILLUMINATION, COMMUNICATION AND POWER PROTECTION.**
.91 **Kinds of Conduit, arranged alphabetically.**
.92 **Wire: 1, Gauges; 2, Kinds.**
.93 **Insulation.**
.94 **Switch-boards; 2, Switches; 3, Cut-outs; 4, Transformers; 5, Sockets, Receptacles, Rosettes.**
.95 **1, Bells; 2, Speaking Tubes; 3, Telephones; 4, Batteries; 5, Letter Boxes.**
.96 **1, Burglar Alarms; 2, Door Openers; 3, Lightning Rods; 4, Other Branches.**
.97 **Fixtures** (See 729.99).
.98 **Power Machinery.**
.99 **Laws. Company Restrictions, etc.**

697 HEATING, VENTILATION AND STEAM POWER.
.1 **FIRE PLACES.** Dampers and Ash Drops. Trimmings.
.2 **STOVES.**
.3 **FURNACES.**
.4 **HOT WATER AND STEAM.**
.41 **Hot Water;** 1, Low Pressure; 2, High.
.42 **Steam;** 1, Low Pressure; 2, High; 3, Vacuum.
.43 **Boilers;** 1, Steel Water Tube; 2, Steel Flue Tube; 3, Cast-iron Sectional; 4, Grates; 5, Setting.
.44 **1, Valves;** 2, Pipes; 3, Regulators; 4, Trimmings for Boilers; 5, Thermometers.
.45 **Radiation, arranged alphabetically.**
.46 **Pipe Covering.**
.47 **Steam Engines, Pumps, Separators, Feed Water Heaters, etc.**
.5 **ELECTRIC AND OTHER METHODS.**
.6 **LAUNDRY MACHINERY. CLOTHES DRYERS.**
.7 **FUELS. Fuel Handling Machinery.**
.8 **SMOKE FLUES. SMOKE PREVENTION.**
.9 **VENTILATION.** 1, Air Ducts; 2, Conduits; 3, Registers; 4, Fans.

698 PROTECTIVE, PRESERVATIVE AND DECORATIVE COVERING. (Painting, Wall-Hanging, Glazing, Floor Covering).
.1 Painting; .11, Oil; .12, Cold-water; .13, Stains Ext.; .14, Enamel Ext.
.2 **Distemper and Fresco.**
.3 **1, Varnishing; 2, Polishing Wax; 3, Staining; 4, Enamel.**
.4 **Other Modes of Protection.**
.5 **Glazing.** See 748, Stained Glass. .1, Stained Glass; .2, Plate Glass; .3, Ornamental Glass; .4, Prisms; .5, Mirrors.
.6 **Paper-hanging.**
.7 **Textile Hangings. Tapestry.**
.8 **Relief Work. Lincrusta. Stamped Leather, etc.**
.9 **Other branches. Carpets, Curtains and Rugs, Rubber Matting and Tile.**

699 **CAR AND SHIP BUILDING.**

/00 FINE ARTS.

701 **PHILOSOPHY. THEORIES. UTILITY. AESTHETICS.**
702 **COMPENDS. OUTLINES.**
703 **DICTIONARIES. CYCLOPEDIAS.**
704 **ESSAYS. LECTURES. ADDRESSES.**
705 **PERIODICALS. MAGAZINES. REVIEWS.**
706 **SOCIETIES. TRANSACTIONS. REPORTS, ETC.**
707 **EDUCATION. STUDY AND TEACHING OF ART.**
708 **ART GALLERIES AND MUSEUMS.**
.1 **American. Corcoran, Metropolitan, Boston. .2 English. National, Hampton Court, Windsor. .3 German. Dresden, Munich, Berlin, Vienna. .4 French. Louvre, Luxembourg. .5 Italian. Vatican, Sistine, Pitti, Medici, Borbonico. .6 Spanish. Madrid, Seville. .7 Russian. St. Petersburg, Hermitage. .8 Scandinavian. Copenhagen. .9 Other Countries.**
709 **HISTORY OF ART IN GENERAL.** Divided like 930-999.

710 LANDSCAPE GARDENING.
711 **PUBLIC PARKS.**
712 **PRIVATE GROUNDS. LAWNS.**
713 **WALKS. DRIVES. BRIDGES.**
714 **WATER. FOUNTAINS. LAKES.**
715 **TREES. HEDGES. SHRUBS.** See also 634.9, Forestry; 582, Botany.
716 **PLANTS. FLOWERS.** .1, Plants; .2, Flowers; .3, Conservatories; .4, Window gardens; .5, Ferneries.
717 **ARBORS. SEATS. OUTLOOKS.**
718 **MONUMENTS. MAUSOLEUMS.**
719 **CEMETERIES.** See also 393.1, Earth burial; 614.61, Public health.

720 ARCHITECTURE.
.1 Theories, Esthetics, Architectonics; .2, Compends, Manuals; .3, Dictionaries, Cyclopedias; .4, Essays, Lectures; .5, Periodicals; .6, Societies; .7, Education, Study, Training, Schools of Architecture; .8, Polygraphy, Collections; .9, General History of Architecture, divided geograically like 940-999.
721 **ARCHITECTURAL CONSTRUCTION.**
.1 **Foundations.** See Bridge Engineering, 624.1, Foundations.
.2 **Walls, Partitions, etc.**
.3 **Piers. Columns.**
.4 **Arched Constructions.**
721.5 **Roofs.** See 695, Roof Coverings;
.6 **Floors and Flooring.** See 620.8.
.7 **Ceilings.**
.8 **DOORS. ENCLOSURES. WINDOWS.**
.81 **Doors, Wood.**
.82 **Doors, Metal.**
.821 Single; .822, Double; .823, Sliding; .824, Concealed; .825, Fire-proof; .826, Sheet Metal on Wood; .827, Wire-glazed; .828, Vault; .829.
.84 **Windows, External.**
.85 **Windows, Internal.**
.86 **Architectural Treatment of Doors and Windows.**
.87 **Shutters, Blinds, Screens, Grilles.**
.871 Shutters, Wood; .872, Shutters, Steel; .873, Blinds, Ordinary; .874, Blinds, Venetian; .875, Screens, Insect.
.876 **Grilles, Wood.**
.877 **Grilles, Ornamental, Metal** (See 694.92).
.8771 **Window and Door Guards.**
.8772 **Stair Railings.**
.8773 **Elevator Enclosures.**
.8774 **Office Enclosures.**
.88 **Fastenings, Locks** (See 694.24).
.89 **Other Fixtures.**
.9 **Iron and Composite Structures.** See 620.1 for Strength of Materials. Classify here only that which cannot be placed elsewhere, under 721, etc.

721 .91 Cast-Iron Structures; .92, Wrought-Iron Structures; .93, Steel Structures; .94, Composite Structures; .95, Steel and Wood; .96, Steel and Stone; .97, Steel and Ceramic; .971, Steel and Brick; .972, Steel and Tile; .973, Steel and Terra Cotta; .98, Steel and Glass; .99, Wood and Glass

722, 723, 724 **HISTORY OF ARCHITECTURE.** Classify modern American buildings of importance in the History of Architecture under 724; generally all other American buildings under 725 to 728 inclusive.
Modern foreign buildings are usually placed under 724, unless of special importance as examples of the class or purpose, when they are to be treated like American buildings.

722. **ANCIENT OR PRIMITIVE ARCHITECTURE.**
.0 **Prehistoric.**
.02 **England.**
.04 **France.**
.07 **Russia.**
.08 **Scandinavia.**
722.11 **China.**
.12 **Japan.**
.13 **Korea.**
.14 **Philippine.**
722.2 **Egypt.**
.3 **Phoenician, Jewish, etc.**
.4 **India, East.**
.5 **Western Asia.**
.7 **Roman.**
.8 **Grecian.**
.9 **Other Ancient Styles.**

723. **MEDIAEVAL, CHRISTIAN, MOHAMMEDAN.**
.1 **Early Christian.**
.2 **Byzantine.**
723.3 **Mohammedan.**
.4 **Romanesque.**
723.5 **Gothic.**

724. **MODERN.**
.1 **Renaissance;** .111, Scotland; .115, Ireland; **.12, England;** .121, Elizabethan; .122, Jacobean; .123, 17th Century; .124, 18th Century; **.13, Germany;** .136, Austria; **.14, France;** .141, Francis I; .142, Henry IV; .143, Louis XIV; .144, Louis XVI; .145, Empire; **724.15, Italy;** .151, Cinquecento; .152, High Renaissance; .153, Decadence; .154, Rococo; **.16, Spain;** .169, Portugal; **.17, Russia;** .171, Canada; .172, Mexico; .173, United States; .1, Old Colonial; .2, Spanish Colonial; .178, South America; .1, Brazil; .2, Argentina; .3, Chili; .4, Bolivia; .5, Peru; .6, Ecuador; .7, Venezuela; .9, Paraguay; **.18, Scandinavia;** .181, Norway; .185, Sweden; .189, Denmark; **.19, Minor Countries;** .192, Holland; .193, Belgium; .194, Switzerland; .199.
.2 **Classical Revival. Grecian.**
.3 **Gothic Revival.**
.4 **Tudor Gothic Revival.**
.5 **Queen Anne Revival.**
724.6 **Neo Grec.**
.7 **Half-Timber Swiss.**
.8 **Romanesque Revival.**
.9 **Other Recent Styles.**

725 **PUBLIC BUILDINGS.**
.1 **Administrative. Governmental.**
.11 Capitols. Houses of Parliament.
.12 Ministries of War, State, etc.
.13 City and Town Halls. Bureaus. Public Offices. City Plans.
.14 Custom Houses. Bonded Warehouses. Excise Offices.
.15 Court Houses. Record Offices.
.16 Post Offices, General and Special.
.17 Official Residences. Palaces of Rulers.
.18 Barracks. Armories. Police Stations
.181 National Barracks.
.182 State Barracks.
.183 Armories. Barracks.
.184 National Police Buildings.
.185 State Police Buildings.
.186 City Police Buildings.
.19 Engine Houses. Fire Alarm Stations

.2 Business and Commercial.
.21 Stores, Wholesale and Retail.
.22 Mixed Store, Office, and Apartment Buildings.
.23 Office Buildings. Telegraph. Insurance. Loft.
.24 Banks. Safe Deposit. Savings.
.25 Exchanges. Boards of Trade.
.26 Markets.
.27 Cattle Markets. Stock Yards.
.28 Abattoirs.
.29 Other Business Buildings.

.3 Transportation and Storage.
.31 Railway Passenger Stations.
.311 Small (country) Stations.
.312 Large (city) Stations.
.313 Union Stations.
.314 Stations on two levels.
.315
.316
.317 Street-car Stations.
.318 Elevated R. R. Stations.
.319 Underground R. R. Stations.
.32 Railway Freight Houses.
.33 Railway Shops, Round Houses, Car Houses, Tanks, Stores.
.34 Dock Buildings. Wharf Boats and Houses.
.35 1, Warehouses; 2, Cold Storage; 3. Safe Deposit Storage.
.36 Elevators, Grain.
.37
.38
.39 Other.

.4 Manufactories.
.41 Textile Factories or Mills. Wool, Cotton, Silk.
.42 Breweries. Malteries. Distilleries.
.43 Foundries. Machine Shops. Iron and Steel Works.
.44 Wood-working Mills. Furniture Factories.
.45 Carriage and Car Factories.
.46 Paper Mills.
.47 Mills for Flour, Meal, Feed, etc.
.48 Pottery, Glass, Terra Cotta, Brick Works.
.49 Other Manufactories.

725.5 **Hospitals and Asylums.** See also 725.6. Reformatories.
.51 Sick and Wounded. Eye and Ear. Incurables. Lying-in.
.52 Insane.
.53 Idiotic. Feeble-minded.
.54 Blind. Deaf and Dumb.
.55 Paupers. Almshouses.
.56 Aged.
.57 Children. Orphans.
.58 Foundling.
.59 Soldiers' Homes.

.6 Prisons and Reformatories.
.61 State Prisons. Penitentiaries.
.62 Jails. Cell Houses.
.63 Reformatories for Adults. Houses of Correction.
.64 Reform Schools.
.65 Washingtonian Homes. Inebriate Asylums.

.7 Refreshment. Baths. Parks.
.71 Cafés. Restaurants.
.72 Saloons.
.73 Baths: Warm, Medicated, Turkish, Russian.
.74 Swimming Baths.
.75 Buildings for Watering Places, Spas, etc.
.76 Buildings for Parks and Streets. Public Comfort Stations.

.8 Recreation.
.81 Music Halls.
.811 Auditoriums.
.82 Theatres. Opera Houses.
.83 Halls for Lectures, Readings, etc.
.84 Bowling Alleys. Billiard Saloons.

725
.85 Gymnasiums. Turn Halls.
.86 Skating Rinks. Bicycle Rinks.
.87 Boat Houses. Bath Houses.
.88 Riding Halls and Schools.
.89 Shooting Galleries.
.9 Other Public Buildings.
.91 Exhibition Halls.
.92 Temporary Halls. Tabernacles. Wigwams.
.93 Workingmen's Clubs and Institutes.
.94 Town Squares.

726 ECCLESIASTICAL AND RELIGIOUS.
.1 Temples.
.2 Mosques.
.3 Synagogues.
.4 Chapels. Sunday-school Buildings.
.5 Churches.
.51 Frame.
.52 Brick or Stone.
.521 Small Audt., seating less than 600.
.522 Large Audt., seating more than 600.
.6 Cathedrals.
.7 Monasteries. Convents. Abbeys.
.8 Mortuary. Cemetery Chapels. Receiving Vaults. Tombs.
.9 Other. Y. M. C. A., etc.

727 EDUCATIONAL AND SCIENTIFIC.
.1 Schools.
.11 Ward and Grammar.
.12 High Schools.
Study and Recitation Rooms. Not including dormitory or boarding.
.2 Academies. Seminaries. Boarding Schools.
.3 Colleges. Universities.
.4 Professional and Technical Schools. Law, Theology, etc.
.5 Laboratories: Physical, Chemical. See 542.1, **Biological, etc. Zoological and Botanic Gardens.** See also 590.7 and 580.7.
.6 .1, Museums. .2, Herbariums. See 580.7.
.7 .1, Art Galleries. .2, Studios.
.8 Libraries. See 022, Library Buildings.
.9 Other. Learned Societies, etc.

728 RESIDENCES.
.1 Tenement Houses.
.11 City Homes of Poor.
.12 Country Homes of Poor.
.13 Cités Ouvrieres.
.2 Collective Dwellings.
.21 Flats; one family to the floor.
.211 Small Flats less than 8 rooms.
.212 Large Flats, 8 rooms or more.
.22 Apartment Houses; more than one family to floor.
.221 Five Suites or Less.
.222 Six Suites or More.
.2221 Elevator Service.
.2222 No Elevator Service.
.3 City Houses. Mansions. Palaces.
.31 Between party-walls. Stone.
.32 Between party-walls. Brick.
.33 Between party-walls. Partly wood.
.34 Semi-detached, including end houses in city blocks. Stone.
.35 Semi-detached, including end houses in city blocks. Brick.
.36 Semi-detached, including end houses in city blocks. Partly wood.
.37 Detached. Stone.
.38 Detached. Brick.
.39 Detached. Partly wood.
.4 Club Houses. Buildings for Secret Societies.
.5 Hotels.
.51 City Hotels.
.52 Summer Resorts.
.53 Country Inns.
.6 Village and Country Homes.
.61 Village Dwellings. On small lots.
.62 Stone.
.63 Brick.
.64 Concrete or stucco.
.65 Part masonary, part wood.
728.66 All wood. 1, less than 7 rooms; 2, 7-12 rm; 3, 13 rm or over.
.67 Farm Houses.
.68 Laborers' Cottages. 1, Frame; 2, Masonry.
.7 Seaside and Mountain Cottages. Chalets.
.8 Country Seats.
.81 Castles.
.82 Chateux.
.83 Manor Houses.
.84 Villas
.85 Log Houses.
.86 Bungalows.
728.9 Out-Buildings.
.91 Porters' Lodges.
.92 Servants' Quarters.
.93 Kitchens and Laundries.
.94 .1, Stables. .2, Carriage Houses. .3, Garages.
.95 Barns, Granaries.
.96 Dairies.
.97 Ice Houses.
.98 Conservatories. Green Houses. Graperies.
.99 Other.

729 ARCHITECTURAL DESIGN AND DECORATION.
.1 The Elevation.
.11 Composition; .12, Distribution; .13, Proportion; .14, Light and Shade; .15, Perspective effect; .15, .16, .17, .18, .19.
For projection of shadows and graphics of light and shadow see 515.63 and 515.7.
.2 The Plan.
.21 Elements required; .22, Distribution; .23, Proportion; .24, .25, .26, .27, .28, .29.
.3 Elementary Forms. For construction of these forms see 721.
.31 Walls. Mouldings. Cornices. .32, Piers, Columns, Pilasters, Pedestals and the Orders. Colonnades. .33, Arches and Arcades. .34, Vaults and Domes. .35, Roof. Spires. Dormers. .36, Towers. .37, Gables and Pediments. .38, Doors and Windows. Bays. Oriels. .39, Stairs and Balustrades. See also 515.83, Stereotomy; 604.8, Building.
.4 Painted Decoration.
729.5 Decoration in Relief.
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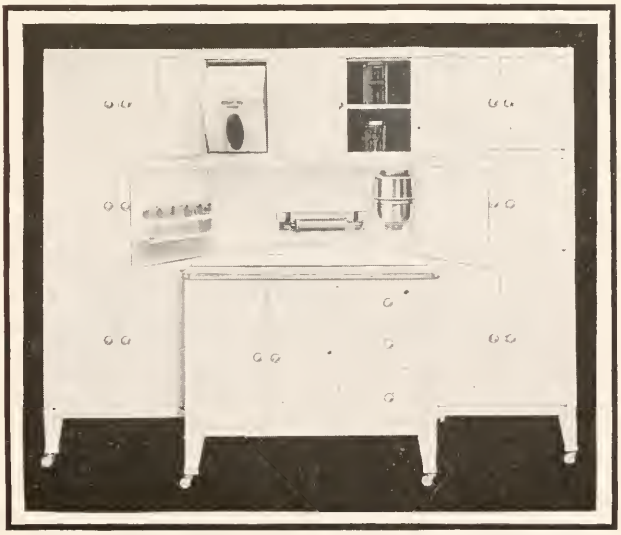

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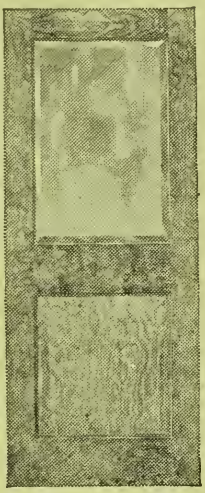

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